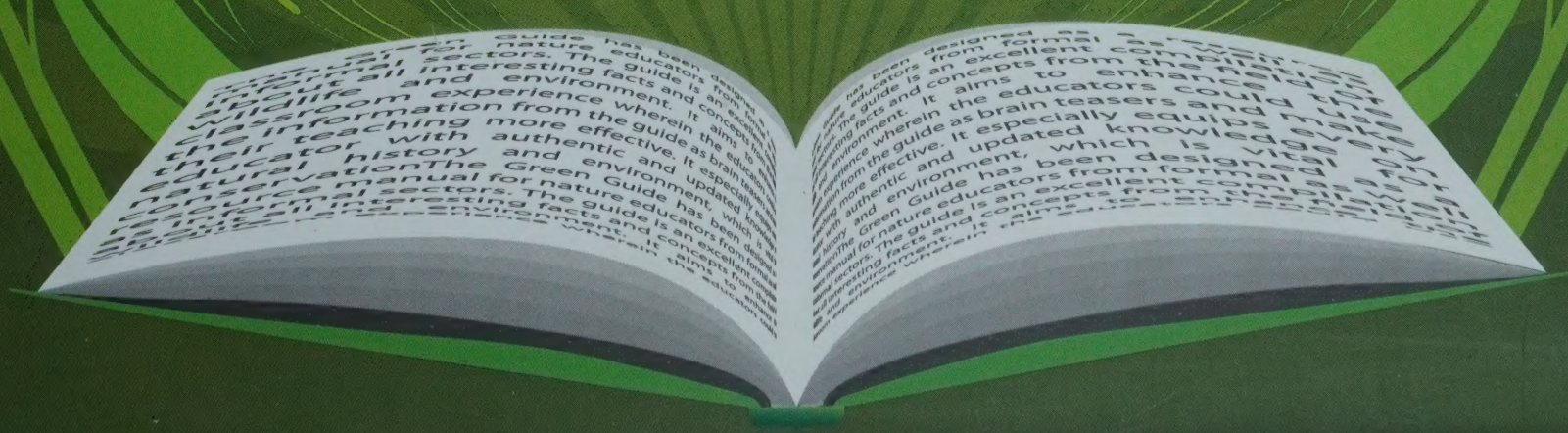
Bombay Natural History Society

Green Guide For Teachers



About Us

The Bombay Natural History Society (BNHS India) established in 1883, is India's best recognized wildlife research NGO. Much of the ecological information on India is an outcome of research carried out by BNHS scientists and its members for more than a century. The BNHS has many achievements to its credit, ranging from the conservation of many wild species and habitats to research and documentation of flora and fauna.

The Conservation Education Centre (CEC) represents the education department of BNHS. It conducts innovative and interactive educational programmes for different target groups such as children, teachers, trainers, NGOs, corporate and government officials. The Centre has been designing and disseminating educational resources to spread awareness about biodiversity conservation.

For more details log on to www.bnhs.org

The Sir Dorabji Tata Trust, one of the oldest, non-sectarian philanthropic organizations in India, was established in 1923 by Sir Dorabji Tata with the prime purpose of encouraging learning and research, of meeting costs of relief during crises and calamities and of carrying out worthwhile charitable activities.

The Mumbai Metropolitan Region (MMR) Environment Improvement Society was set up by the MMRDA in 1996 to support research and implementation activities in the areas of environment improvement. The objective was to promote protection, preservation, improvement and monitoring of environment in the Mumbai Metropolitan Region through undertaking studies, surveys, demonstrations, investigations, research and related activities.

Green Guide For Teachers

Project by

BNHS INDIA CONSERVING NATURE SINCE 1883

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Acknowledgement

The Green Guide has been designed as a resource manual for environmental educators from formal as well as non-formal sectors. The guide is an excellent compilation of interesting facts and concepts from the field of wildlife and environment. It aims to enhance the classroom experience wherein the educators could use the information from the guide as brain teasers and make their teaching more effective. It especially equips every educator with authentic and updated knowledge on natural history and environment, which is vital for environment education.

This book has been developed through financial assistance from Sir Dorabji Tata Trust and MMR Environment Improvement Society.

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About the Green Guide

This book has been developed as an environmental education resource for teachers. It has been designed keeping in mind the need of interactive learning for students. This guide is aimed towards making classroom learning enjoyable and interesting with inclusion of interesting facts and stories from natural world. Also to ensure that student projects are carried out in a systematic manner. The Green Guide serves as singular, comprehensive resource on environmental education, thereby shifting the emphasis from referencing and compiling notes to actual learning and teaching by teachers.

The guide covers following seven themes:

1. Did You Know?
2. National Parks and Wildlife Sanctuaries
3. Threatened Flora and Fauna
4. Trade in Wildlife
5. Environmental Issues
6. Green Projects
7. Green Deeds

The facts and information on natural history in the 'Did You Know?' section may be incorporated into any lesson to generate instant interest. The sections on 'Threatened Wildlife' and 'Trade in Wildlife' clearly describe our natural treasures and why they are in danger and furthermore, where they can be found is discussed in the 'National Parks and Wildlife Sanctuaries' section. 'Environmental Issues' brings to light the hazards faced by mother nature and 'Green Deeds' illuminates the path to curbing these by small actions that can be taken in everyday life. This would fulfill the objectives of environment education and help teachers to bring about the much desired attitudinal and action changes among the students.

Another aim of this guide is to make the differentiation between activities and projects and promote the project method as hands-on learning tool. The guide can also benefit nature clubs within the school with its clearly outlined and easily executable projects from the 'Green Projects' section. The information and projects are suitable for all age groups and should be adapted to suit the needs of the educator. Alongwith this guide, it is essential to use current articles, videos and books to broaden the scope of the subject and stimulate discussion.

The language of the guide is simple and the supporting illustrations and photographs make it interesting to read. The information has been compiled from various sources which includes BNHS publications, course material and various websites both national and international that provide information on environmental issues. The list is provided at the end of the guide.

Did You Know?

This section includes facts and figures from natural history. You could use these facts as brain teasers in your classroom. The information could also be used to conduct instant classroom quizzes. The content could be linked to Science and Language subjects.

LIMCA RECORDS OF PLANTS

Tallest Bamboo

- **Oldest Tree in the Country:** A Shaitoot tree at Joshimath in the Chamoli District of Uttarakhand is believed to be about 1,200 years old. Another is the Deodar tree at Balcha, Garhwal, which is said to be 704 years old.
- **Tallest Trees:** Fir and Deodar grow to an average height of 76.2 m.
- **Fast Maturing Trees:** The Eucalyptus and the Subabul trees mature very fast. They are both ready for cutting in just 8 to 9 years. Because of their fast growth, both these trees were introduced in India for afforestation.
- **Tallest Bamboo:** The tallest bamboo found in Assam and Bengal grows to a height of 30.4 to 36.5 m. with a diameter of 20-25 cm. The bamboo flowers only once in its lifetime and depending on the species, it flowers every 15, 30, 60 or 120 years after which it dies.
- **Largest Tree Canopy:** A Banyan tree in the Anantapur district of Andhra Pradesh, has the largest canopy. The tree covers an area of 0.021 sq.km and is believed to be over 600 years old.
- **Biggest Tree Trunk:** The majestic Deodar found in Jammu and Kashmir and Himachal Pradesh has trunks measuring a record 12 m or more in circumference.
- **Largest Hollow Tree:** A Baobab tree or Monkey-bread tree of African origin, standing amidst the ruins of the eastern part of the historic Golconda fort near Hyderabad, has a hollow of 10.9 m. that can comfortably accommodate 10-12 people. The 700 year-old tree is 29 m wide at the base.

Giant Water Lily

- **Largest Leaf:** The leaf of the water lily *(Victoria amazonica)* is the largest of all leaves. It measures 1.5 m in diameter. A six-year old can easily sit on it. It can be seen at the Botanical Garden in Kolkatta.
- **Heaviest Wood:** Anjan *(Hardwickia binata)* is found in Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu and is the heaviest wood, having a specific gravity of 1.25.
- **Lightest Wood:** Balsa *(Ochroma lagopus)*, found in Tamil Nadu, has a specific gravity of 0.12 - 0.15 and is the lightest wood.
- **Blackest Wood:** Ebony *(Diospyros melanoxylon)*, the darkest wood, is found in Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Orissa and Karnataka.
- **Longest Creeper:** The Elephant Creeper *(Entada pursaetha)* can grow to a length of 1.5 km, making it one of the longest in the world. It has enormous bean-shaped pods over 1.5 m and 10 cm wide containing chocolate-coloured seeds. It grows in the eastern Himalayas and in the Western Ghats.

FACTS ABOUT DANGEROUS PLANTS

Castor Plant

- **Most Poisonous Plant:** The Castor P lant *(Ricinus communis)*, which is cultivated worldwide to make castor oil, contains ricin, the most lethal plant poison. A single seed weighing 0.25 gm is enough to kill a human being.
- **Most Dangerous Tree:** The Manchineel Tree *(Hippomane mancinella)* of the Caribbean coast and the Florida Everglades exudes a highly poisonous and caustic sap, once used as arrow poison. One drop in the eye can blind a person and a bite of the fruit causes blistering and severe pain. The slightest contact causes the skin to erupt in blisters.
- **Most Carcinogenic Agent:** The microscopic fungus *(Aspergillus flavus)* produces alfatoxin B1, one of the most powerful carcinogens known. As little as 10 mg triggers liver cancer in rats.
- **Most Fatal Fungus:** The toadstool *(Galerina sulcipes)* is the world's most lethal fungus, with a fatality rate of 72%, if ingested.
- **Deadly Stingers:** New Zealand's Tree Nettle *(Urtica ferox)* can kill a horse. Its stinging hairs inject a mixture of potent poisons. In 1961, a man in New Zealand's hill country stumbled into the plant and by the time he reached hospital was blind, paralyzed and had severe breathing problems. He died within five hours.
- **Dangerous Water Stinger:** Toxins produced by fireweed *(Lyngbya majuscula)*, a marine , fine, hair-like cyanobacterium found worldwide, cause a burn-like rash known as sea bather's dermatitis. In severe cases, the skin blisters, peels, and the victims suffer irritation of the eyes, nose and throat, skin sores, headache and tiredness.
- **Most Poisonous Flower:** All parts of the attractive Oleander *(Nerium oleander)*, a plant that is common throughout the world, are extremely dangerous. Bees that gather too much nectar from its flowers make poisonous honey and people have died after eating meat cooked on skewers made from oleander wood.
- **Most Destructive Weed:** The weed that attacks the largest number of crops in most countries is the Purple Nutgrass or Nutsedge *(Cyperus rotundus)*. The land weed is native to India but attacks 52 crops in 92 countries.
- **Itchiest Cactus:** The Prickly Pear Cactus *(Opuntia robusta)*, native to Mexico and more commonly known as the prickly pear, has bristles barbed like bee stings. They are used to make the world's strongest itching powder.

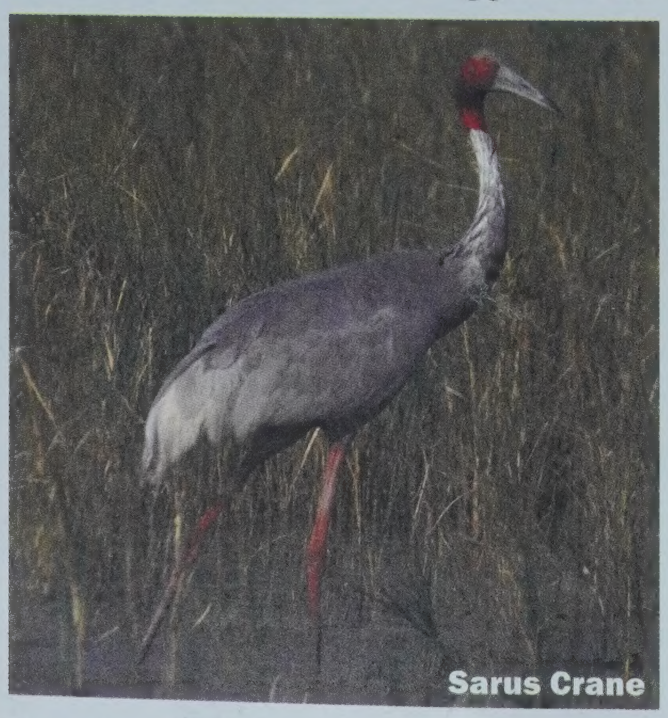
Oleander Plant

THE BIGGEST AND SMALLEST

- Blue Whale is the biggest mammal measuring 32.4 m long. Its as along as eight elephants in a row. It weighs 3 tonnes at birth and reaches an average weight of 26 tonnes by the age of 12 months.

Blue Whale

- The Bumblebee Bat or Kitti's Hog-nosed Bat is the smallest mammal in the world. It is less than $\frac{1}{1000}$ m the length of a Blue Whale. It is slightly longer than our thumb. It measures 2.9 cm in length and has a wingspan of about 13 cm. It weighs 1.7 gm.
- Cuban Bee Humming Bird is the world's smallest bird that weighs less than 2 gm and measures a little over 5 cm. Its no longer than one of our fingers.
- Ostrich is the largest flightless bird, standing 2.75 m high and taller than a tall person.
- West Indian Gecko *(Sphaerodactylus ariasae)* is the smallest reptile. It can lie within a spoon of 18 mm diameter.
- King Cobra is the longest venomous snake in the world, measuring upto 5 m, while the Reticulated Python is the longest reptile in the world, the record being upto 18 m in length.
- Cuban Poison-Arrow Frog is the smallest amphibian. It is about the size of a coin.
- Giant Salamander is the biggest amphibian, which grows to a length of 1.8 m long and can weigh up to 13 kg. The Chinese Giant Salamander can weigh up to 65 kg.
- Dwarf Pygmy Goby *(Trimmatom nanus)* is the smallest fish. It is no longer than our fingernail. The male is 8.6 mm long and the female is 8.9 mm.
- The Whale Shark is the biggest fish. It is a little longer than a railroad train coach.



Sarus Crane

- Giant Spider Crab is the biggest arthropod. Its body is as big as a basketball.
- Sarus Crane is the tallest flying bird in the world, standing 1.52 m tall, while the Tickell's Flowerpecker is the smallest Indian bird measuring just 7 cm long.
- Queen Alexandrian Birdwing (28 cm) is the largest butterfly in the world. It weighs 25 gm.
- Among Indian butterflies, Southern Birdwing (female, 19 cm) is the largest and the Grass Jewel is the smallest (1.5 cm).
- The longest insect in India is a Tropical Stick Insect from South India, which measures 30 cm long and the smallest insect is a Hairy Winged Beetle measuring 0.25 cm.

- Atlas Moth is the largest moth (30 cm) of the world. The wingspan is as long as a footruler.
- The smallest flower is that of the Duckweed, which are barely 1 mm wide and the largest flower known to science is 1 m wide, produced by a parasitic plant of the Sumatran jungles, named *Rafflesia arnoldii*.
- Nilgai is the largest antelope in India, standing 130-140 cm tall, while the Four-horned Antelope is the smallest which is 55-60 cm tall.
- The largest turtle in the world is the Leatherback Turtle, which is also found in the Indian Ocean. The smallest sea turtle in the world is Pacific Ridley Turtle.

FACTS ABOUT MAMMALS

- Fossil records from the Himalayas show that many animals, which, at present do not occur in India, were present during the earlier times. Animals such as Giraffes, Hippopotamus, Chimpanzees, Orangutans, and Baboons, which are foreign to us now, had roamed on our land.

White Tiger

- Wild cats are found in every continent except in Australia, where they have been introduced by man.
- India is the only country where the three of the big cats i.e. Lions, Tigers and Leopards are found in the wild.
- The Asiatic Lions are found only in Gir forest of Gujarat.
- All the white tigers in the world are the progeny of two strains, the most famous are of a male white tiger, which was captured in 1951 from the forest by the Maharaja of Rewa, Madhya Pradesh.
- Black Panther, found in some parts of India, is actually a melanistic leopard, whose spots have become almost invisible against the black background.
- Lions are the only cats that live in the family groups, called prides. Other cats prefer to lead a solitary life.
- Chausingha or the Four-horned Antelope is the only animal in the world to have four horns.
- The Cheetah is the fastest land animal. It can run at about 110 kmph, but only for a short distance, and in a straight line. Unfortunately, this big cat is now extinct in India. The last Indian cheetah was shot in 1949.
- The elephant tusk is a modified incisor and the longest tusk recorded for an Asian Elephant was 209 cm and 336 cm for an African Elephant.
- The Giant Panda feed on bamboo, a tall, tough grass with very little food value in it. An adult panda has to eat about 20 kg of bamboo stems a day.

Cheetah

Did You Know?

- Gibbons and humans are the only primates that can walk comfortably on their hind legs.
- The nocturnal Slender Loris found in South India is the smallest and lightest among the Indian primates. The males weigh 280-340 gm and the females weigh 225 gm. They are tailless and have a head and body length of just 20-25 cm.

Slender Loris

- The 30-40 cm long Slow Loris found in Northeastern India is the slowest mammal on land. The slowest mammal in the water is the 3.2 m long Dugong or Sea Cow, found in the Gulf of Kutch, the Gulf of Mannar, and the Andamans in India.
- Among the Indian primates, the Hoolock Gibbon found in Assam and Arunachal Pradesh is the tallest, standing at almost 90 cm, and is the only ape found in India.
- Chimpanzees are among the most intelligent animals in the world. They even make tools by ripping the leaves off thin sticks and poking them into termite-hills to draw out termites.
- Dogs have much better hearing than human beings do. Wild Dogs can hear a ticking watch from a distance of 10 m away. 'Dhole' or Indian Wild Dog is the only dog that can 'whistle'.
- The Brow-antlered Deer is the only deer species to have a floating habitat and is found only in the Logtak Lake in Manipur. The deer lives on swamps made up of a thick mat of humus and dead vegetation, which actually floats on the water. The thickness varies from 10-60 cm. The deer have slightly splayed out hooves with horny and hairless pasterns to keep them from sinking through.
- The Tiger is the heaviest among the big cats. The average body length for the males is 2.9 m weighing 230 kg, while the females are 2.6 m in length and weigh 180 kg.
- The common Indian Field Mouse is the smallest among Indian rodents, which is just 5-8 cm long with 5 cm long tail.

Indian Porcupine

- The Indian Porcupine, found commonly in hilly areas all over the country, is the largest among the Indian rodents, having a head and body length of 70-90 cm and tail length of 8-10 cm and weighs 11-18 kg.
- The Great One-Horned Rhinoceros, also known as Indian Rhino, is the largest among the Asiatic Rhinoceros. An adult male weighs as much as 2070 kg.
- The rare Asiatic Wild Ass is found only in the Little Rann of Kutch and Ladakh. It is closely related to the Horse and Zebra.
- The highest record of man-eating by a tiger is the tigress of Champawat district of Uttarakhand, which claimed 436 lives in 1907, before being shot by Jim Corbett.
- Flying Foxes or Fruit Bats are the largest among the bats having a wingspan of 122 cm. They are important pollinators of some trees such as mangoes, but on the other hand, they are more destructive, as they voraciously feed on banana, guava, mango and chikoo.

- The Indian Bison or Gaur is the tallest among the world's wild oxen, with adult bulls weighing up to 900 kg and standing 1.95 m at the shoulder.

Sloth Bear

- Sloth bears have a special liking for termites. Their mouth, nostril and lips are specially adapted for sucking insects. With protruding lips and nostrils that can be closed at will, they are able to easily suck out termites from their mounds.
- The Indian Wild Dog or Dhole is an animal that hunts in groups (pack). They use two strategies while hunting. Either they kill their prey, as the whole pack moves through the forest in an extended line or they have some members of the pack waiting to ambush the fleeing prey flushed out by other members of the pack.

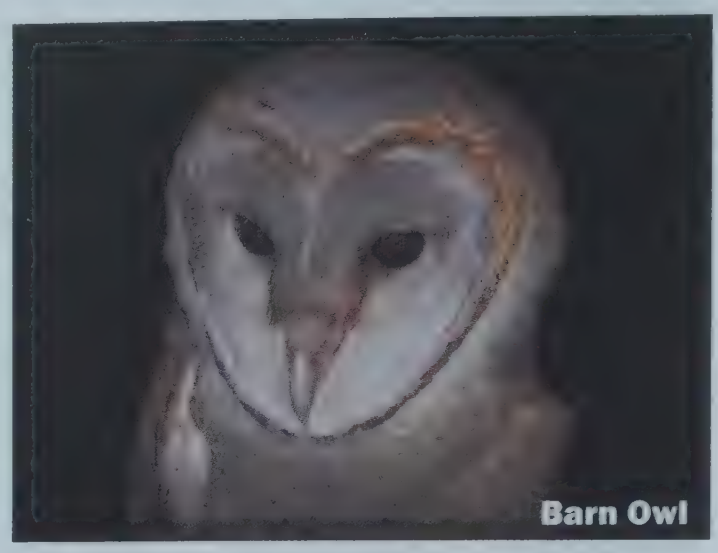
FACTS ABOUT BIRDS

- Several birds that dwell on cliffs lay eggs shaped like tops. If by accident, the eggs begin to roll, they will roll in smaller circles instead of rolling out straight on the rocks below.
- Ducks produce special waterproofing oil from a gland at the base of their tails. They use their bills to spread this oil over their feathers. That is how their feathers are protected from getting wet while they are in water. While all birds have this preen gland, it is well developed in waterbirds.
- All Indian Vultures have a naked head and neck except the White Egyptian Vulture, which has only naked yellow head, the neck is covered with feathers. The Black or King Vulture has a bright red head and neck. Those species with naked head and neck feed on the inside of the animal carcass, while others feed from the outside.
- Babblers are earthy brown to greyish brown birds. Strong bonding among these birds has been observed due to which they are always found in a group. That is how they have gained the Hindi name '*Saat bhai*' and 'Seven Sisters' in English.
- The European Black Vulture is the largest vulture having a wingspan of over 2.4 m., whereas in India, the Cinereous Vulture and the Indian Griffon Vulture are the largest while the smallest is the White Egyptian Vulture.
- While the Koel calls to herald the beginning of the Mango flowering, the Pied Crested Cuckoo (*Papeeha*) is considered the harbinger of monsoon.
- Before migrating, birds feed intensively to build up reserves of fat to fuel them on their long voyages across deserts or oceans.

Pied Crested Cuckoo

Did You Know?

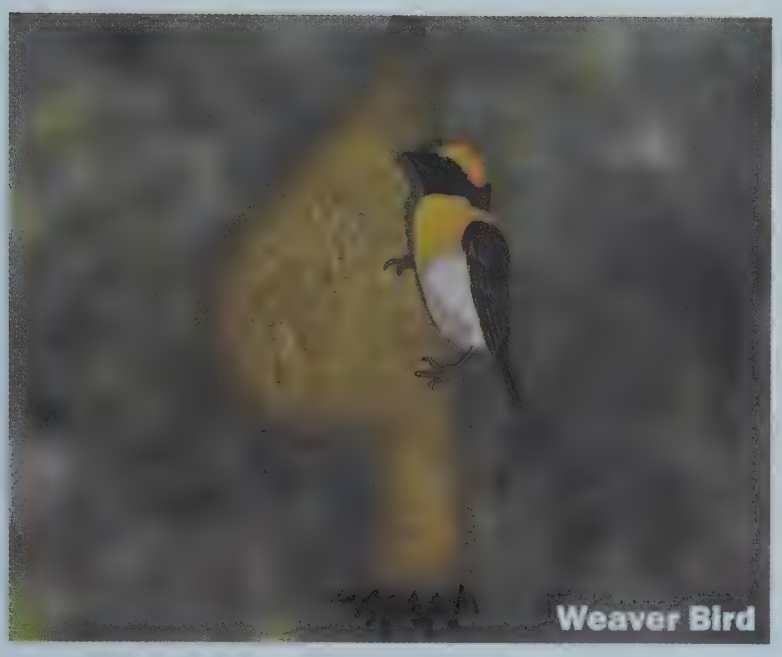
- Flamingos are filter feeders, living on algae and tiny animals which live in the mud, such as shrimps, molluscs and insect larvae. The animals they eat contain pigments called carotenoids, which occur naturally in a wide variety of animals and plants. These carotenoids give flamingos their distinctive pink colour.
- The Barn Owl's night vision is 100 times better than that of human beings.
- Birds sometimes encourage ants to swarm over their feathers. Poisonous formic acid produced by the ants may dislodge parasites in the bird's plumage. This process is called anting.
- In order to take care of their feathers, birds indulge in 'dust baths'. Dust is both absorbent and abrasive. Bathing in dust cleans a bird's plumage by scouring dirt from the feathers.


Barn Owl

- Nightjar is an insect-eater, which begins to forage for insects from dusk onwards. By day, it stays completely still, looking like a broken branch. There are records of resting nightjars being trodden on by walkers who have not noticed birds right beneath their feet.
- A group of owls is called Parliament and a group of ravens is called Murder.
- Unlike other birds that incubate their eggs by their body warmth, the Megapode of the Nicobar Islands buries its eggs in a large mound of scraped-up sand and leaves them to be incubated by the heat generated within by fermentation of humus. The chicks on emergence are self-reliant.

Frogmouth

- Cave-dwelling Swiftlets are the only birds to use sonar while maneouvering through darkness. Its sonar consists of clicking sounds at frequencies of 1,500 to 5,500 hz audible to the human ear. Not only can they navigate in total darkness, but they can also find their own individual nest among hundreds of others.
- Many birds are named after their beaks. Spoonbills as the name suggests, have a long beak with a spoon-shaped tip. The Crossbill Finch has its bill crossing over the lower one. The Frogmouth has a broad bill resembling the mouth of a frog.
- Members of the crow family, such as the Raven, are the acknowledged intellectuals of the bird world.
- The Hill Myna and the Racket-tailed Drongo are two famous bird mimics that have a fantastic repertoire of whistles, wails, shrieks, gurgles, groans and squeaks. Each individual uses 3 to 13 such calls, none of which are shared with its mate, but many, which are shared with its neighbours. However, the Hill Myna never imitates other birds in wild. That is the specialty of the Racket-tailed Drongo.
- The Peregrine Falcon is the world's fastest bird. Although its speed is often exaggerated, it can probably dive at a breath-taking 360 kmph in pursuit of other birds.
- Ducks like the Shoveller migrate every winter. A migrating duck can travel up to 1600 km in a single day, averaging nearly 70 kmph.


Weaver Bird

- Male Weaver Birds weave extraordinary trumpet-shaped nests with help of their beak and feet. The hanging nest prevents predatory snakes from getting inside it.
- Pallas' Fishing Eagle is an excellent hunter. It hunts its own prey such as fish, snakes, small mammals and crabs as well as pirates prey from other larger birds, forcing them to surrender their lawful catch.
- Osprey is a fish-eating hawk commonly found in winter on many larger water bodies. It flies up and down over the water, scanning the surface for any fish coming up within striking depth. On sighting a fish, it closes its wings and hurls itself upon the fish, striking the water with a great splash and often becoming completely submerged. The fish is grasped in the talons and carried off.

FACTS ABOUT FISHES

- When in danger from big fishes, the Flying Fish jumps out of water, and is known to glide over 100 m above water. The elongated fins and the specialized tail enable it to perform this unusual task.
- The Puffer Fish that is found both, in the sea and in brackish waters have smooth, scaleless skin with small soft prickles. The intestine has off-shoots into which air or water can be pumped so that the fish when alarmed, can puff itself up like a balloon. Although the flesh can be eaten, the skin, reproductive organs, liver and gut are extremely poisonous. However, in Japan, reputed and experienced chefs prepare a special dish prepared from puffer fish called "Fugu".

Puffer Fish

- Catfishes got their name from long cat-like whiskers, which are sensitive to touch and help the fish in locating food, obstacles and enemies.
- Carp fish may hold as many as two million eggs in its ovaries.
- Fish sleep with their eyes open. They shut their pupils as they have no eyelids.
- The Archer Fish not only shoots a jet of water at insects but also takes small leaps to catch the insects sitting above the water.
- Some deep-ocean fish, such as the Viper Fish, carry their own 'lighting arrangement' or have bioluminescent organs. These organs consist of light-producing cells, lenses and reflector surfaces situated on different parts of the body. The light organs help in finding food, attracting prey and warn enemies.
- Fishes undertake long migrations either for food, breeding or climatic changes. Surprisingly enough, these migrations are not always in the same quality of water, being sometimes from salt water to fresh water or deep sea to shallow water or vice versa.

Did You Know?

Climbing Perch

- The Climbing Perch was discovered in 1791, in India, by a Dutch naturalist called Daldorff, who found the fish 1.5 m up a palm tree, enjoying a trickle of water that ran down the trunk.
- Electric Rays, Eels and certain Catfishes can produce their own electricity through specialized tissues and give shocks of over 200 V. to their prey as well as enemies.
- Some fishes such as carps and sharks could be trained to limited extent. A shark is reported to have learnt to strike a target and swim away for a promised morsel of food.
- The Basking Shark, weighing 25 tonnes, is the heaviest among fishes.
- For centuries, people have appreciated the rough texture of shark skin, using it as a natural sandpaper or non-slip sword grip.
- Large fishes like carps are known to live as long as 50 years, while smaller fishes live up to one year.
- Coelacanth is an ancient group of fishes that had lived from 300 to 90 million years ago and thought to be extinct. Today, this fish is considered a living fossil after its rediscovery in 1938 off the coast of east Africa at a depth of 80 m.

Seahorse

- The Seahorse is an unusual fish with the head of a chess piece, the tail like a monkey's, a ridged body that seems to be carved from wood and eyes like a chameleon. The female lays her eggs inside the male's pouch from which the babies hatch.
- Flat Fishes are very unique fishes which when born, are like normal fishes that swim vertically but slowly and steadily as they grows, the eye on one side gradually shifts to the other side and lies next to the other eye. With this change, the other side of the fish becomes blind, so the fish uses this as the underside and swims in a flat plane.
- Mudskippers are walking fishes found in swampy and marshy areas. These fishes can prop themselves up and skip quickly on their muscular pectoral fins, which look like stubby crutches.
- The Atlantic Manta or 'Devil Fish' is the largest living ray fish weighing about a ton and with a fin-span exceeding 6 m. Despite their overwhelming size, mantas have small teeth and are gentle filter feeders.
- Doctor fishes such as the small wrasses wait at regular spots, often at the same time each day, and are approached by larger individuals that require treatment. The doctor fish then picks fragments of food and parasites off the skin, fins, gills and mouth-even right inside the throat.

- Lion Fishes or Scorpion Fishes are one of the most poisonous in the sea. The spiny rays in its decorative, lacy fins house glands, which make a powerful venom that can disable predators and has been reported as fatal to humans.

- Anglerfish get their name from the dorsal fin, which is modified to form a long angling 'rod' complete with 'bait'. When the fish is hungry, it remains motionless on the sea bottom, waving its 'bait-like' tip near its gaping mouth. An unsuspecting fish investigating the worm-like wriggling movement of the bait finds itself sucked into the mouth and devoured.
- The Stonefish has a warty, blotched body that blends perfectly into the stony seabed. It also allows weeds and anemones to grow on its skin, to aid camouflage. In defense, the fish raises the spines along its back. These can inject the most potent of all fish venoms, even through the soles of beach shoes. A sting can maim, or even kill.

FACTS ABOUT REPTILES

- The Golden Tree Snake, or Gliding Snake, found in the hilly forests in the Western Ghats and north-east part of India is an energetic, rapid-moving tree snake. Active by day, it hangs high up in the trees of thick forests, hunting for lizards and occasionally for frogs. It jumps from branch to branch and even glides through the air to lower levels. It flattens its body to increase air resistance.
- The only snake in the world, which makes a nest to lay eggs, is the King Cobra found in dense evergreen forests of the Western Ghats, Orissa, Bihar, West Bengal, Andamans, northeast and northern hills. It primarily feeds on other snakes.
- Turtles are marine reptiles, while tortoises are land dwellers and terrapins are fresh water tortoises.
- Crocodiles don't have to clean their teeth because the plover bird does this job for them. The crocodiles allow the bird to pick its teeth for scraps of food.

- People often use the phrase 'crocodile tears', which means false tears. However, the crocodile's tears are just a way of getting rid of the salt from the water that it swallows along with its food.

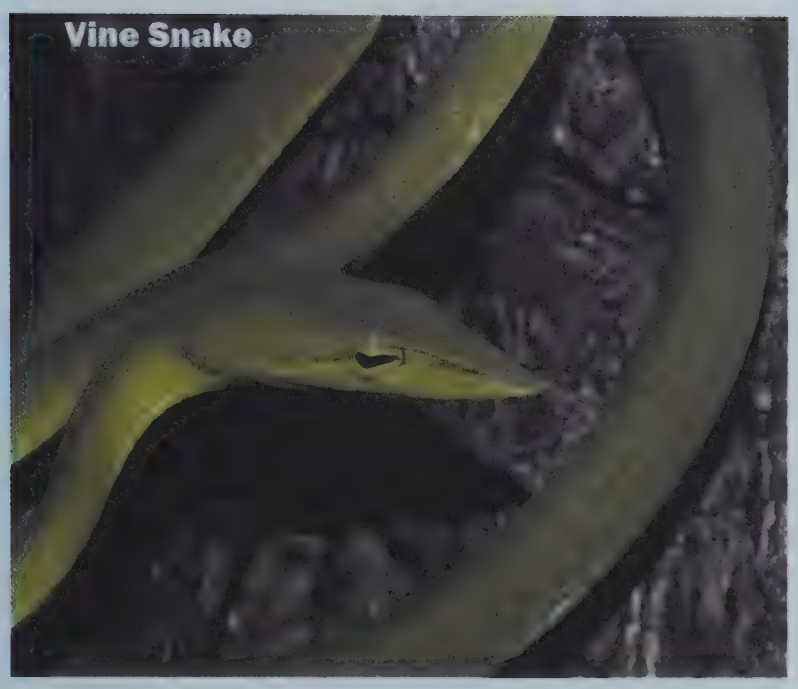
Did You Know?

Draco Lizard

- The Gliding Dragon is another name for the Draco Lizard. This lizard can spread out folds of skin to form "wings" that it uses to glide through the air from tree to tree. It lives in southern and northeastern forests of India.
- Leopard Geckos are unusual as they have movable eyelids. Most geckos, like snakes, cannot blink, but have a fixed, transparent spectacle protecting their eyes. Their toes end in tiny strong adhesive pads, which can cling to smooth surfaces.
- The Green Turtle's ability to migrate hundreds of miles from its feeding ground to its nesting beach is considered one of the most remarkable acts in the animal kingdom.
- Gharial is the strangest of all the crocodiles; it has a long narrow snout with rather small, piercing teeth. Males have a knob or "ghara" on the tip of the snout, which it uses to ward off rivals by producing the loud buzz.
- The Tokay Gecko, the largest of all Indian geckos, which grows to 36.5 cm, is found in northeastern India. It derives its name from its cry '*toukay*'. It usually preys on cockroaches and other geckos but it will also take a small bird or rat.
- Every year some 2,00,000 Olive Ridley Turtles come to Orissa, to nest along just 5 km of beach of Bhitarkanika. Each female digs a hole in which she lays about 100 eggs and then returns to the sea.
- Several days before a snake is ready to shed its skin, its eyes look cloudy. Its skin appears dull and colourless. It loses its appetite, and may become aggressive. Many snakes also look for water, as they lose a considerable amount of body fluids along with their skins.
- In Garden Lizard during the breeding season, the head, shoulder and parts of forelegs turn bright scarlet or crimson. In fact, the mouthparts of some species become so red that they have been nicknamed "bloodsuckers".

Chameleon

- Chameleons are the true masters of camouflage. Many can make the colour of their skins lighter or darker as needed. Although these changes take place so that the Chameleon can match its background, many other things influence the colour change. Light level, temperature and the mood of the lizard can all affect the colour it takes on.
- A Chameleon can rotate its eyes quite independently, so that the animal can see forward with one eye, whilst looking sideways or backwards with the other.
- Rat Snakes and Bronze-back Tree Snakes are fastest among snakes, which can reach the speed of 10 kmph.


Vine Snake

- The Vine Snake spends hours motionless, hanging in the trees. Because it is bright green and has a very slender body, it is well hidden. Its eyes face forwards, giving it binocular vision. As a result, it is good at judging distances, especially when lunging at passing lizards.
- Many snakes can delay egg fertilization, in some cases for months after they have mated. This ability to control the development of young is very useful to snakes.
- The Pit Viper, one of the venomous snakes, is able to locate warm-blooded prey with the help of two heat sensors situated between its nostrils and eye.
- The Common Indian Krait's venom is considered 15 times deadlier than the cobra's and it is among the most deadly venomous snakes in the world. In addition, its venom is the costliest venom at Rs. 2,000/- per gm.
- The Snake Lizards or Legless Lizards are found in the high hills of Darjeeling district, Sikkim and the Khasi Hills. It moves like a serpent by lateral undulations and employs its tongue in a snake like fashion.
- The Starred Tortoise gets its name from the distinctive colour pattern. The carapace has a yellow central areola on a black background with yellow streaks radiating out from areola, giving a star like appearance.
- One of the most famous enemies of many snakes, but in particular the cobra, is the mongoose. In any fight, the mongoose is likely to be the victor, relying on its speed and agility to avoid the lunges of the snake. The mongoose will dart in and bite the back of the snake's neck or it may grab the back of snake's head, until the snake gives up the struggle.

Cobra and Mongoose

We do not inherit the Earth from our ancestors; we borrow it from our children.

by Native American

FACTS ABOUT AMPHIBIANS

- Amphibians were the first land animals. They appeared some 360 million years ago. They evolved from fishes with fleshy, lobed fins that looked like legs.
- Besides frogs and toads, amphibians also include caecilians, newts and salamanders.
- Frogs and toads are the most easily recognized amphibians because they have such a distinctive body shape yet they differ from each other. Frogs are more active, are found in or near water, have smooth skins, long hind legs, and webbed feet, while toads tend to be less active, prefer to live on land, have dry warty skins, and little or no webbing. However, there are few exceptions to both.
- Except male frogs and toads, no other amphibian has the ability to croak.

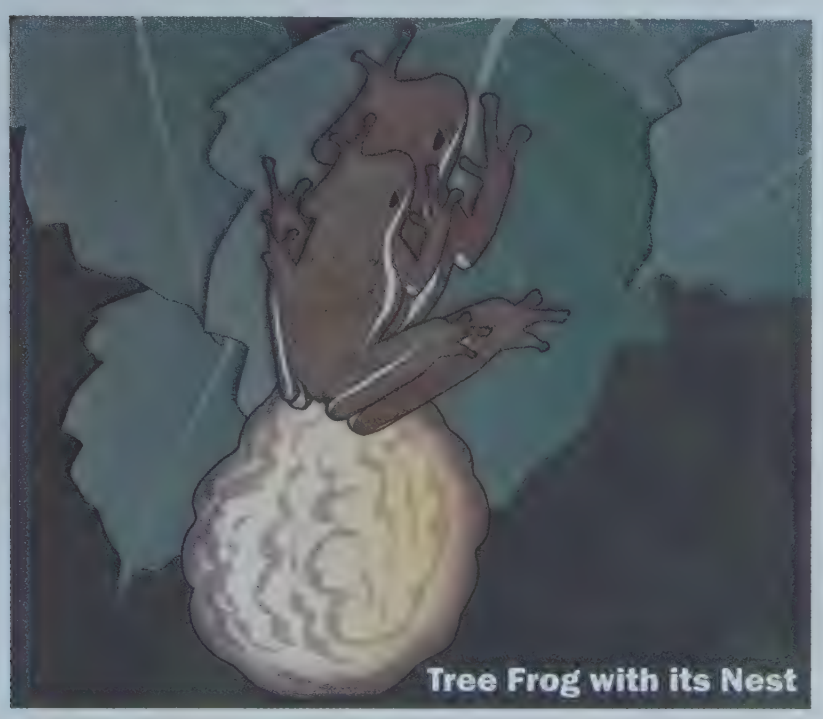
Common Toad

- Salamanders, newts and caecilians are a group of tailed amphibians. Salamanders and newts look very much like lizards while caecilians bear close resemblance to earthworms. Some live on land, in damp areas, and may enter water to breed while others inhabit soft mud and trees. In India we have only a single species of newt in the northeastern hilly region. Caecilians are found in well-forested moist areas of the Western Ghats.

Newt

- Most amphibians will eat almost any live food that they can manage to swallow or gulp down. Insects, spiders, fishes, slugs, and earthworms form the main part of the diet for most adult amphibians.
- Amphibians have an incredible range of colours and markings, from bright blues, reds and yellows to muddy brown and green, with variety of stripes and spots. Like most animals, amphibians either blend in with their surroundings for camouflage or are brightly coloured to warn predators that they are poisonous if eaten. The body colour varies with humidity and temperature - it may become pale when warm and dry, darker if cold and damp.
- True toads have an enlarged parotid or poison gland behind each eye. If a toad is threatened by a predator, a poisonous milky secretion oozes from the gland's pores. When pressed, the toad can squirt the secretion for a short distance. If the predator gets the poison in its eyes or mouth, it suffers a burning sensation and muscle spasm, causing breathing difficulties.

- Not all frogs can leap - some walk, crawl, run or hop for short distances, and certain tree frogs can even "fly", or glide from tree to tree. The most spectacular is the Malabar Flying Frog from Western Ghats. It has long, extra webbed toes. It leaps from trees and extends its fingers and toes; this action creates a parachute or umbrella effect at each limb extremity, and allows the frog to glide to another tree.
- Tree frogs are well adapted for climbing, leaping, and walking on the smoothest, shiniest leaf surfaces. They can even climb up a near-vertical pane of glass, because on the ends of its fingers and toes, there are special discs or pads containing sticky mucus.

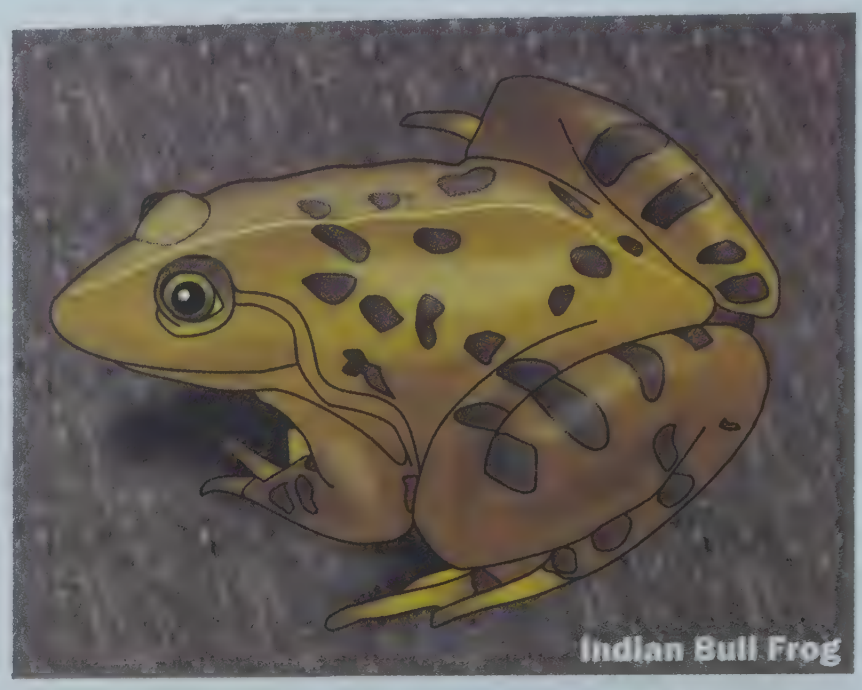

Tree Frog with its Nest

- Many amphibians are caring parents and show many ways of caring for their eggs and young. Some amphibians carry their eggs or tadpoles on their back, or in a skin pocket; others take their eggs inside the body, into vocal sacs, or even into the stomach and some make a nest of foam to lay their eggs within it.
- Tree frogs are the only frogs that make a nest of foam to lay their eggs in. The female secretes a liquid which is whipped in to a foam ball with the hind legs. Both the male and female participate to create a foam in to which the female lays eggs and the males releases sperms to fertilise the eggs. The surface of the foam hardens when dry and the tadpoles fall into the water after hatching.
- In frogs and toads, the males give out a mating call, which attracts females of the same species, but may also attract predators. Courtship behaviour helps to identify the partner as a member of the same species. Amplexus - the mating embrace, places the male in the right position for fertilizing the female's eggs. Fertilization usually happens as the eggs are laid.
- In most newts and salamanders, courtship and mating involves a complex behavioural display by the male for the female. Not only does a male have to find a mate of the same species, but he also has to guide the female over a small sperm packet, or spermatophore, which he deposits on the ground or in a pond. Fertilization is usually internal - the female picks up the sperm packet with her cloaca or reproductive organ.
- Caecilians have a special kind of internal fertilization, where the male inserts the end of his cloaca into that of the female.
- The Indian Black Frog is the rarest frog found among the Annamalai hills of the Western Ghats. It inhabits moist evergreen forests at an elevation of 1220 m.

Caecilians

Did You Know?

- The Indian Bull Frog, found all over the country, can grow up to 15 cm and weigh as much as a kilogram.
- Frogs' legs are eaten in many countries though banned in India. The Edible Green Frog and the Indian Bull Frog were collected in large quantities for export, leading to a rapid decline in the population. The industry in India wastefully killed tens of millions of frogs. In 1977, 1150 tonnes of frogs' legs were exported to USA. In Asia, especially in Southeast Asia, dried toads and frogs are used for 'medicinal' purposes.
- Frogs and toads do a remarkable job of pest control. Large numbers of insects are eaten every day by frogs and toads, including mosquitoes and cockroaches. Toads especially, being indiscriminate feeders, help to keep down the numbers of agricultural pests. Thus, amphibians provide an economic benefit, which is often not readily seen by the communities they benefit. A study by BNHS showed that Indian Bullfrogs were directly responsible for controlling the harmful pest population e.g. mosquitoes and agricultural pests. In 1981 a ban was introduced on trade in frogs' legs on BNHS's recommendation.


Indian Bull Frog

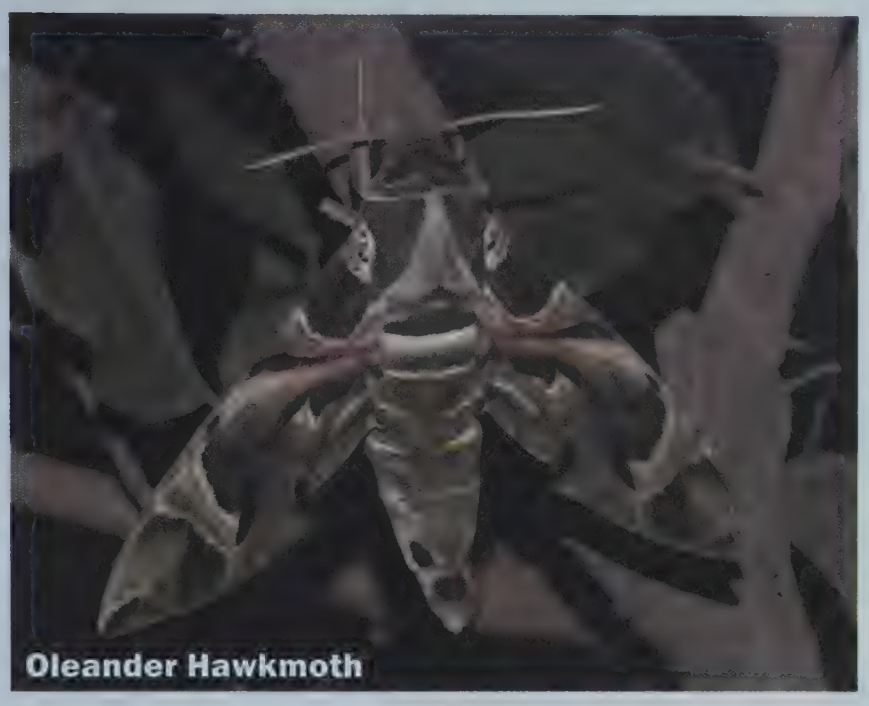
FACTS ABOUT INSECTS

- There are 8,22,074 documented species of insects in the world. In India there are 54,051 species of insects which amounts to 10% of the world's insect diversity.
- Beetles are the largest group of insects with a documented species of 3,50,000 in the world and 15,000 in India.
- Butterflies and moths are the second largest group of insects with 1,40,000 world species of which 15,065 are known from India.
- Ants, bees and wasps are the third largest group of insects with 1,20,000 world species of which 8,000 are found in India.

Cicada

- Among insects, the Cicadas are the loudest insects and owing to their absence in one of the forests in Kerala, the forest was named as 'Silent Valley'.
- Even though the adult cicada lives for four weeks, in some temperate species it takes 17 long years to develop from larva to adult.
- Flies beat their wings 330 times per second. Winged beetles beat their wings 50 times per second. Butterflies beat their wings 12 times per second and the tiny biting midges beat their wings 1000 times per second.

- Shellac, an important industrial material, is produced by the Lac Insect that lives on some forest trees in India and Myanmar. The sedentary female secretes this substance called Lac over its body to protect itself from adverse weather conditions and its natural enemies.
- The swallowtail butterfly caterpillar has a forked, scent gland called 'osmetrium', which protrudes behind the head whenever the caterpillar is disturbed or attacked. It secretes a strong smelling fluid containing organic acids, which the caterpillar tries to rub against the attacker. This defense is effective against ants, parasitic wasps and flies.


Oleander Hawkmoth

- Wild silk moths such as the Atlas, Moon, Tasar, Eri and Muga do not have mouths to feed as they lack stomachs. This is due to their short lifespan, which is mainly utilized in reproduction. Hence the adaptation.
- A moth can "smell" its mate from as far as a mile away.
- The Oleander Hawkmoth is a handsome moth that has camouflaging green colours matching with that of military fatigues. The body patterns break up the body line and make the moth hard to locate in the thick foliage.
- Onset of monsoon is imminent when ants move their eggs from their underground nests to higher areas to save them from getting flooded. This is a signal for farmers to sow their crops.
- Braconid Wasp, a parasitic insect on caterpillars, can sense the caterpillar hidden inside the tree bark and will lay eggs by inserting its long pointed ovipositor into the wood and finally into the caterpillar's body.
- Evanid Wasp, a tiny black coloured wasp is an egg parasite on cockroach eggs. It is usually seen inside houses in search of cockroach eggs.
- An ant can carry as much as 50 times its own body weight!
- Some ants keep slaves, which they get by raiding other nests, killing the queen and taking workers as prisoners.
- Many ants eat the sweet substance called 'honeydew'. It comes from aphides or plant lice as they feed on the sap of plants. The ant strokes the aphid almost as if it were a farmer milking a cow. Sometimes the ants will even pick up the aphides in the jaws and carry them to a new spot.
- In the female-dominated colonies of bees and wasps, males are only born when they are required and after their mating with the queen, they are thrown out of the colony.
- A honeybee is like a kamikaze fighter. It dies when it stings its enemy.
- The cells of a honeybee hive are so perfect and regular that the French scientist Reaumur once suggested they could be used as a unit of measurement.

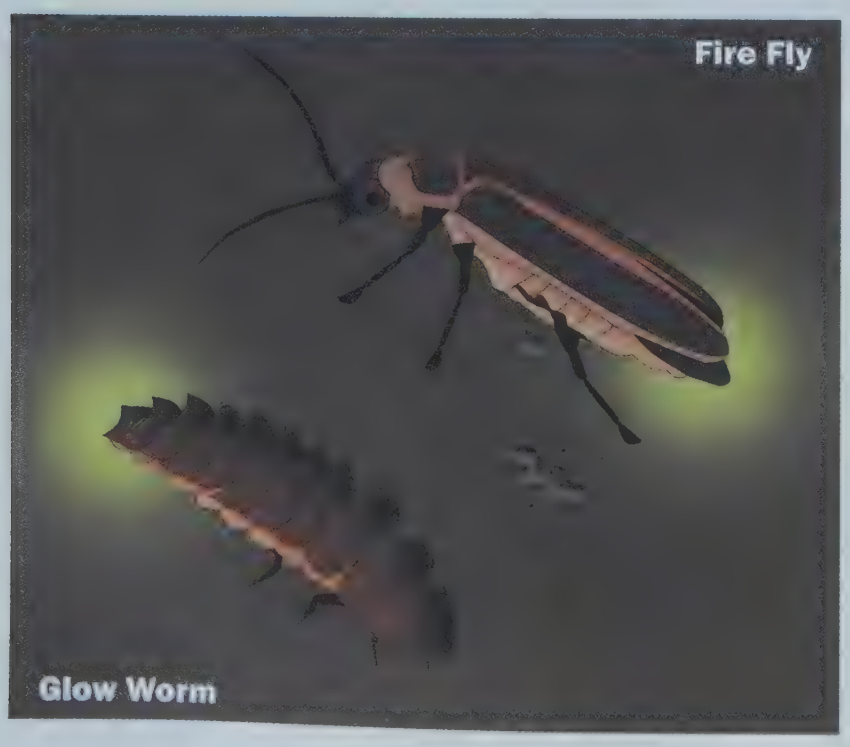
Honey Bee

Did You Know?

- Honey bees are colour blind to red.
- The paper wasp has been making paper long before man "invented" it.
- A fly first samples food with its feet before putting its mouth on to it.
- During a single meal, a female mosquito can drink her own weight in blood, while the male mosquito sucks only plant sap and nectar.
- The male housefly is a short-lived insect. The male lives for only 17 days, while the female live for 29 days. Yet in this short life span, it can transmit 30 known diseases to man.
- A young termite's 'caste' is decided at birth. It grows into the category needed by the nest at that time. When 'upper' class vacancies are filled, it grows up to become a worker.
- Beetles have very tough jaws, which enable them to bite through sheets of copper or zinc.
- The Dung Roller Beetles feed exclusively on dung. Both the male and female together roll a dung ball. After laying an egg inside, they tuck it in a tunnel in soil for the young to complete development.
- The Rhinoceros Beetle is considered one of the strongest creatures. These beetles can carry 850 times their own weight.
- The Bombardier Beetles discharge, explosively and hot chemical spray from their anus to shock and immobilize for a moment their hunters, and use the trick to escape. The spray is a combination of two chemicals, hydrogen peroxide and hydroquinone, and is ejected at a temperature of almost 100° C.

Dung Beetle

- Fireflies are male beetles while glow worms are females as they have no wings, but both can give off green light. This cold light of firefly has luminous efficiency as high as 92 %. The luminous efficiency of the tungsten lamp is 5.5 %.



- 'Ant crickets' are tiny, wingless and almost blind crickets that share ant's nests. They live on secretions produced by ants, which mistake the mimetic insects for their own kind, and may even feed these imposters directly.
- A swarm of locusts may contain as many as 40,000 million individuals, with a collective weight of 80,000 tonnes. They are capable of eating their own weight in food each day. Swarms of locusts have been seen at sea 12,000 miles from the nearest land.
- Some mayflies have only 24 hours or even less to live as adults.
- Caddisflies and caterpillars of some moths called as bagworms or caseworms construct portable cases that are specific to each species, and may be made of twigs, leaves, sand or pebbles.

Cricket

- Crickets hear through their knees, while cicadas hear through their abdomens, as do some moths.
- Some fleas that are barely 2 mm in size can jump more than 30 cm. That is more than 150 times of its body length. In addition, some are even known to jump up to 300 times their body length.
- A cockroach can live up to nine days without its head, or as long as its body's fat reserves last. It then dies because it cannot eat. (Unlike us, a cockroach's circulatory, nervous and respiratory systems are situated in the thorax and abdomen).

FACTS ABOUT MARINE ANIMALS

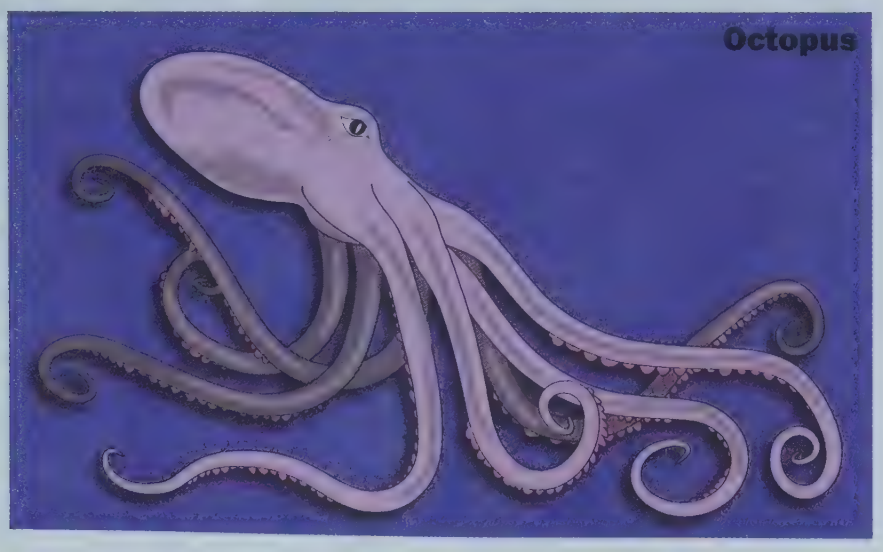
- A sponge is an invertebrate that draws water through a system of pores. The body is riddled with tiny holes, or pores. Water is drawn in through the pores, which act like sieves, and travels through the sponge to pass out by a larger vent. The sponge filters out food particles from the water.
- Jellyfish are bell-shaped, transparent and glassy with their tentacles and internal organs brilliantly coloured. The tentacles are armed with stinging cells, which are used for capturing prey. Some jellyfish have exceedingly powerful venom that can cause great pain to bathers who brush against them.

Jelly Fish

- Comb jellies or sea walnuts are peculiar jellyfishes. They are generally pear or egg-shaped, but some are long like ribbons. They are all beautiful, free-swimming animals, floating on the open sea, emitting iridescent colours and many of them are phosphorescent.
- Starfish are considered the stars of the sea. They have a star-shaped body with five radiating arms. The undersides of their arms is covered with rows of fluid-filled tube feet, which they use for moving and feeding. They can grow new arms if an arm is crushed by a wave swept boulder or mauled by a predator.
- Cuttlefish are not really fish but are related to the octopus. They have an ink sac placed near and connected to the anal opening. They protect themselves by emitting a dark fluid from the sac and hide from their enemies in this smoke screen.
- Corals are calcareous skeletons of minute marine organisms or polyps. The principal builders of coral reefs and islands are the true or stony corals, which secrete the calcareous skeleton externally at the base and lower part of the body. As the colony grows, the polyps on the outer edges multiply, smothering the lower ones and growing upon their skeletons.

Did You Know?

- Sea anemones are hollow jelly-like animals related to jellyfish and corals. Their tentacles are equipped with specialized stinging cells that poison prey, which is pulled inwards to the mouth. Usually they attach themselves to rocks with a basal disc, which works like a sucker. They feed on small animals.
- Brittle stars live on the seabed and feed on dead animals. They resemble starfish but differ in having slender, flexible arms. It throws its fragile arms into serpent-like shapes as it glides swiftly through a shore pool. The arms are brittle and easily broken, but the brittle star is able to grow new ones.
- Sea urchins are spiny, ball-shaped creatures. They are protected by hard case, called a test, made of interlocking plates. The test is covered with protective spines. Most sea urchins are round and live on rocks. Those that live in sand or mud in shallow water have flatter bodies.
- Sea cucumbers are tough-skinned, sausage-shaped creatures related to starfish but in shape and architecture are entirely different. Instead of arms or spines, they have tentacles and five rows of tube feet. They live buried in the sand or under rocks below low-tide marks and also in deep water. The ability of sea cucumbers to contract and escape from their enemies is marvelous. At the slightest disturbance, they squirt out water, shrink to an insignificant mass and recede into a hole in the rock.



- Octopus is a mollusc without an external or internal shell. It is also called 'devil fish' in view of its rapacity when attacking its prey into pieces. Animals caught in its sucker-beset arms can seldom escape. Once caught by the suckers, unless the animal's arm is cut with a knife, any attempt to detach the suckers will be futile.
- Young barnacles are free-swimming with feathery limbs and on maturity they attach themselves by their first pair of antennae to rocks or timber or the hulls of ships and after a resting stage become shelled adults. Their crusty fouling growths are a problem, as they slow a ship's speed. Anti-fouling paints have been developed for hulls, containing chemicals that stop young barnacles from settling.
- Sea slugs are molluscs without shells. They have feathery tufts on their backs, which absorb oxygen from seawater. Some sea slugs are equipped with stinging cells absorbed from anemones that they eat.

Shrimp

- Shrimps and prawns look similar except that shrimps have fatter bodies, blunt claws on the first pair of limbs and they live mostly in sand whilst prawns are thinner bodied, have small, narrow pincers on the first two pairs of limbs and live in pools and among seaweed.
- Fan worms are sometimes mistaken for anemones as only their heads crowned with tentacles protrude out of their tubes like the corolla of flower, but they are related to earthworms. The tentacles of the "fan" filter tiny food particles from the water and withdraw in a flash into the tube if danger threatens.

- Crabs and other crustaceans can escape from danger by discarding an injured or trapped limb. There is a special breaking point near the limb joint with the body along which the tissues are arranged to minimize bleeding. The new limb grows in stages with each moult of the crab's shell, which is usually once each year.
- The Horseshoe Crab or King Crab is an odd-looking creature, which is not a true crab. Judged by its horny shield, awkward movements, marine habitat, and breathing gills, earlier naturalists called it king crab, although, it is the only marine arachnid related to spiders.

Fan Worm

FACTS ABOUT FUNGI

- Fungi are flowerless, primitive organisms that lack chlorophyll and grow mainly on dead and decaying as well as on living plants and animals. They appeared on the Earth about 570 million years ago.
- There are about 1.5 million fungal species on our planet and mankind has succeeded in understanding clearly, only about 70,000 species. Out of these, around 10,000 have been found to be mushroom species, from which 2,000 species are proven edible of which only 80 have been artificially cultivated while about 25 varieties are deadly poisonous.
- The study of fungi is called mycology and Anton de Bary, was one of the first mycologists from Germany.
- Fungi absorb their food from organic matter, either living or dead, through networks of slender feeding threads called hyphae. They break down dead matter, and convert it into a form that other living things can use. The variety of substances that fungi can digest is extraordinary. Some can live on petroleum, others on the thin films that coat lenses. Silica, magnesium, iron, even plastic are all consumed by one kind or another.

Did You Know?

- Fungi occur in soil and in the air everywhere from the equator to the poles up to the limit of vegetation. They grow best at temperatures between 20° C and 30° C but some fungi can grow at temperatures up to 60° C. Still others such as meat infecting fungi can grow readily between 0° C - 10° C.
- Bracket Fungi are flat, shelf-like fruiting bodies, which indicate that a tree is infected by a fungus. The brackets usually grow horizontally from the tree trunk, release spores into the air from their undersides, and become hard and woody. Although they are often slow growing, these are often signs that a tree is slowly dying.

Bracket Fungi

- Rust is a reddish, microscopic fungus that infects some plants. It is different from the iron-oxide that forms rust on iron metal.
- Yeast is a microscopic fungus that usually lives as individual cells. Yeasts carry out alcoholic fermentation, which changes sugars into alcohol and carbon dioxide. This is used to make alcoholic drinks and to make bread rise.
- Fungi produce fruiting bodies to spread their spores from one food source to another. Each species of fungus has particular kind of food, and has evolved its own way of spreading spores. The fruiting bodies of fungi grow in a huge variety of shapes and sizes.
- Penicillin Fungi grow on many damp substances. They are often used in cheese making to flavour cheese. These fungi also produce substances called antibiotics, which destroy bacteria. Penicillin is an antibiotic drug used to combat bacterial infections.
- Ringworm is a fungus that lives in human skin. It lives by digesting keratin, a structural protein found in the skin. They get their name because they form red ring-shaped patches, which were once thought to be caused by worms.

Lichen

- One of the fungi such as luminescent fungus turns fluorescent emitting green light. Forest dwellers get frightened on seeing glowing wood at night as they consider this as the fire of evil spirits.
- Lichens are associations of fungi and algae. The algae live among the fungal hyphae and produce food by photosynthesis, which the fungus feeds on. The partnership between the fungus and the algae is so close that they live like a single organism.
- The term "mushroom" is a common name given to any edible fungus. Botanists do not classify mushrooms and toadstools into separate groups, but the name "toadstool" is generally given to poisonous fungi.
- Mushroom is a hundred percent vegetarian delicacy. Low in calories, and high in B-vitamins and minerals. They are also rich in proteins that contain most of the essential amino acids,

Fly Agaric Mushrooms

required for human beings. They are almost devoid of fats and cholesterol. The True Morel and Guchhi of commerce are collected in Jammu and Kashmir and Himachal Pradesh and sold at fabulous prices.

- Many toxic mushrooms like Fly Agaric and Death Cap or Destroying Angel are poisonous if eaten in quantity. They may cause hallucinations and even death when eaten.
- Ear Fungi are mysterious fungi, which look exactly like a human ear. It is fleshy, soft ,pale pink in colour; later on matures to dark brown. Usually grows on dead planks of wood.
- Puffball Mushrooms have ball-like fruiting bodies. They begin their life as solid balls of cells. The cells slowly dry out and the outer skin of the ball becomes papery. If an animal or raindrop touches the skin, spores puff out through a hole in the top of the fruiting body, hence the name.
- Truffles of commerce, which occur in France and Italy, grow underground. These are located with the help of dogs and pigs, who can smell them and dig them out. In France, there is museum named after a fungus 'Truffles', which stores all the information on this particular type of fungi.
- Veiled Mushroom, a strange looking mushroom having a broad hollow stem in the centre with a muddy cap, from the rim of the cap grows out the veil, which covers the stem in a circular manner. The muddy cap emits a fermented sugary odour, which attracts small insects. Looking at this mushroom, one is reminded of a Christian bride with a veil over her face.

Veiled Mushroom

The universe is not required to be in perfect harmony with human ambition.

by Carl Sagan

National Parks and Wildlife Sanctuaries

This section will provide an insight about our protected areas. You could use this information in the classroom as general knowledge. It could be linked to Science as well as Geography subjects.

Tiger Sighting at BNHS Camp

Wildlife watching is more than a momentary pleasure. Seeking wildlife can be stimulating to mind, body and soul. It can sharpen your senses; increase your outdoor skills and teach you about relationships of living things to the Earth. Ultimately, it can give you a spiritual bond with life and nature. Nearly everyone likes to see wildlife. Whether it is backyard birds crowding around a feeder or a tiger stalking a deer in the wild, we take delight in watching these animals that share the planet with us. It is even more rewarding if this simple interest broadens into an understanding of animals' lives and a care for the environment that sustains both them and us.

The term wildlife applies to all living things; that comprises of every species of plants (flora) and animals (fauna), excluding man and domesticated animals. Nowadays wildlife has almost become synonymous with the National Parks and the Wildlife Sanctuaries. Wild animals in their natural habitat have shrunk in these Protected Areas (PAs). Our splendid wildlife is well preserved in these areas and any one who is interested in wildlife may see the wild animals in these areas. Wild animals can also be seen in the zoos, safari parks, circuses and in laboratories but all these places are the artificial homes of wild animals. Protected areas are the best scientifically preserved natural habitats of wild animals and are the only hope where the wild populations of various animals are expected to survive.

The first PA, Vedanthangal Bird Sanctuary in Tamil Nadu, was created in the early 1900s. The first national park was created in 1935 under the name of Hailey National Park (now Corbett National Park), Uttarakhand.

IMPORTANCE OF NATIONAL PARKS AND WILDLIFE SANCTUARIES

It is paradoxical that in India - the land of Ashoka, Gautam Buddha and Mahatma Gandhi, with an ancient tradition of love, respect and reverence for all life, so many among our unique fauna face a threat to their survival. Much of the present day depletion of our wildlife may be attributed to the over-exploitation of natural ecosystems and resources to meet the needs of an ever-increasing human population. Habitat destruction and wildlife poaching pose the most serious threat to the survival of wildlife.

However, since Independence, India has accorded high priority to conservation of wildlife as can be seen from the number of governmental measures undertaken, like establishment of national parks and sanctuaries, formulation of Wildlife Protection Act, special projects for conservation of endangered animals, institutional support and conservation education.

National parks and wildlife sanctuaries hold some of the most precious species of the country's animal and plant kingdom. Years of protection and scientific management have saved many species from the brink of extinction. Not only have individual species been saved, but also their habitats and entire ecosystems restored to health.

Earlier in 1988, about 1,00,000 sq. km (3 %) of India's geographic area was declared as protected area, which was very less as far as conservation was concerned. Today India has a wide network of 99 national parks, 514 wildlife sanctuaries which totals up to 613 protected areas, that covers 4.79% of the country's geographical total.*(See the table given at the end of this section)*

ABOUT NATIONAL PARKS AND WILDLIFE SANCTUARIES

India spreads over an area of almost 3.29 million sq.km, encompassing a gamut of habitats that sustain a sizeable percentage of the world's faunal and floral wealth. Its avian diversity doubles that of Europe and conservative estimate attributes about 10% each of the world's mammalian, insect and fish species and over 8% of reptile forms to India.

Definitions

A **National Park** is an area where the natural or historical objects of national significance are protected along with the wildlife therein, in such manner and by such means, as will leave them unimpaired for the enjoyment of future generations. Such protected areas are created by Central Legislation and enjoy highest level of legal protection. They usually form the focal area of the Project Tiger Reserves. The human activity is confined to management duties and controlled tourism, strictly enforced by law.

A **Wildlife Sanctuary** is a place where some rare, wild, indigenous mammals, birds, reptiles and any other form of wildlife are found in good numbers and represents a region that needs protection together with the natural environment. The State Forest Department creates such protected areas. The Chief Wildlife Warden monitors human activities such as livestock grazing, collection of forest produce and tourism, within the sanctuary's precincts.

Both national park and wildlife sanctuary have their areas divided into a core area and a buffer area. The core area is supposed to be the most crucial and vital habitat for the existing flora and fauna. It receives the most stringent care. Apart from management inputs, no human activity, not even tourism, may be allowed here. Whereas, the buffer area lies between the outside boundary of park or sanctuary and the core area. In the case of a sanctuary, most of the human activity is restricted to this area only. There are few protected areas, which have double identity of a wildlife sanctuary as well as national park.

Some Common Misconceptions About Protected Areas

Misconception no.1: A national park is managed by the central government and a sanctuary by the state government.

Truth: Both are under state government jurisdiction. Both can also be declared by the central government.

Misconception no. 2: A national park is larger than a sanctuary.

Truth: Not necessarily, there are many sanctuaries much larger than many national parks. Essentially, a national park has greater legal protection, as virtually no human activity or resource use is allowed inside.

Misconception no. 3: No human activities can be allowed inside a protected area declared under the Wildlife Protection Act.

Truth: In a sanctuary, continuation of human rights and resource use activities are allowed provided the Collector and the Chief Wildlife Warden agree. In a national park, rights are not allowed to continue and all resource uses are supposed to cease though for some strange reason, tourism does not seem to be so restricted! Exceptions of this total prohibition are activities that may be necessary for wildlife management, e.g. grass cutting by villagers inside Keoladeo (Bharatpur) National Park, Rajasthan, to maintain the area's wetland character.

PROMINENT NATIONAL PARKS AND WILDLIFE SANCTUARIES

1. Corbett National Park

Location: In the folds of Garhawal and Kumaon Siwalik ranges in the Uttarakhand.
Established in: 1936 as Hailey National Park, then renamed as Ramganga and finally as Corbett in 1957.
Area: 1,318.54 sq.km.
Introduction: This was the first national park of India, which became famous after the writings of Jim Corbett. The forests consist of both dry and moist Siwalik Sal together with dry mixed deciduous forest. It has spectacularly large meadows, which provide excellent grazing for animals and viewing of wildlife. The Ramganga River cuts across the park and a large artificial lake has been formed by damming the river at its northern extremity.

Among the wildlife, the herbivores include elephant, chital, sambar, barking deer and hog deer and on the slopes of the Himalayan foothills goral can be seen. There are a fair number of tigers and panthers. Panther kills are often seen on tree branches where they are hidden for safety, as is the custom with this predator. There are also wild boar, leopard cat, Indian civet and jackal. The Ramganga River abounds with mahseer and is hence very popular with anglers. Both, the marsh crocodile as well as the gharial are found in the Ramganga River and in the newly created reservoir. Other reptiles include monitor lizard, python and a large number of snakes. There are more than 400 species of birds.

Walking is prohibited for the safety of the tourists in most areas and wildlife can be viewed as unobtrusively as possible from elephant backs or open jeeps. The thunderous trumpet of the elephant, the roar of the tiger, the flutter of wood pigeons and the shrill whistle of the soaring crested serpent eagle are all familiar sounds of this forest.
Best time to visit: December-April, as it is closed for the tourists from mid-June to mid-October during the monsoon season.

2. Dachigam National Park

Kashmir Stag

Location: In the Himalayan foothills west and north of Kashmir Valley.
Established in: 1981 as a national park prior to the status of Sanctuary.
Area : 141 sq.km.
Introduction: The park originated as a game reserve and was further developed to protect the catchment area of the Dagwan River. Dachigam's temperate, broad-leaved forests and grassy meadows constitute nearly half of the catchment area of Dal Lake. The park is divided into two parts based on the hilly terrain; Lower Dachigam (1700 m) and Upper Dachigam (4200 m).

Today, the park is famous as the home of the last viable population of the highly endangered Hangul or Kashmir Stag. Other species found include, the Brown and Black Bear, Musk Deer and Fox and over 150 species of birds. This is an excellent park for trekking and camping. Sightings of snow leopard have been reported. Other interesting sightings are of Himalayan Monal and Koklass Pheasant. The most impressive draw however, is the Kashmir Stag with its widespread antlers, a frequent sight in the forest and surrounding grassy slopes.
Best time to visit: June-August for Upper Dachigam and May-June, September-December for Lower Dachigam.

3. Desert National Park

Chinkara

Location: Jaisalmer, in the Thar desert of Rajasthan.
Established in: 1980
Area: 3,162 sq.km.
Introduction: The park is the home of the highly endangered Great Indian Bustard. Although known as a national park, much of the area in fact has only sanctuary status. The area as a whole has its own distinct wildlife. Very little of the area is a Sahara type of desert with rolling sand dunes, otherwise much of the area is covered with patchy scrub, and at places even trees and shrubs. Summers are very harsh and temperatures exceed 50°C. The plants have adapted themselves to the harsh climate and although many are leafless, they provide shelter and shade for many animals.

There are several Bishnoi villages in the sanctuary area. Black Buck and Chinkara are usually seen nearby. Other animals seen include wolf, desert fox, hare and desert cat. Many birds of prey such as the tawny eagle, short-toed eagle, spotted eagle, kestrel and laggar falcon are also seen. Other birds seen here are sandgrouse, grey partridge, bee-eaters, larks, shrikes and more. Demoiselle crane and Houbara Bustard arrive in the winter. Even this seemingly listless realm is behest by human demands, especially for water. It is the world's most populated desert but as wildlife experts point out, the national park is a unique genetic storehouse of Indian desert wildlife, which needs only a bare minimum to flourish.
Best time to visit: December-March.

4. Eravikulam National Park

Location: In the high hill ranges of Kerala.
Established in: 1978
Area: 97 sq.km.

Nilgiri Tahr

Introduction: The park covers beautiful rolling grassy hills and forested valleys. Endless acres of tea plantations have altered the original habitat of the high ranges, along the southern tract of the Western Ghats, leaving pristine forest only on steep slopes and in deep valleys. Eravikulam's formidable range of attractions includes the spectacular mass flowering of Kurunji shrub, which blooms once in 12 years. This is the best place to see the Nilgiri Tahr. This park has the largest tahr population. The herd of tahr is very comfortable on steep slopes. In order to view some of its other wildlife, it is necessary to explore much further into the park. It has the highest peak in South India: Anaimudi (2695 m). The trek to the foot of Anaimudi hill will reveal elephant, leopard, dhole, nilgiri langur, lion-tailed macaque, giant squirrel and perhaps a tiger also. There are nearly 100 species of birds including the Rufous-bellied Eagle and the Black and orange flycatcher, which can be found only in restricted areas of south-west India.
Best time to visit: November-April.

5. Gir National Park

Location: In the district of Junagadh in Gujarat.
Established in: 1975
Area : 258.71 sq.km.
Introduction: The only place where one can see the Asiatic lions, which is the last stronghold for the lions. The habitat is undulating, low hill country with elevations ranging from 152 to 530 m above sea level. The main species of trees are teak, flame of the forest, fig and thorn

forests of acacia and zizyphus. Besides lions, other mammals to be seen are panther, sambar, spotted deer, nilgai, four-horned antelope, chinkara, boar, hyena, jackal, langur, porcupine and the black-naped hare. There are over 100 bird species including the painted sandgrouse and several species or raptors. Being on the main north-south migratory route, bird life is particularly rich in the winter months.

Since it is the only area where the Asiatic lion exists, the park is of particular significance. The Asiatic lion was once widely distributed and its range included the Punjab, Bengal and a large part of the Kathiawar peninsula. The last lion killed outside Kathiwar was in 1884. Since then, this species has been restricted to the neighbourhood of the Gir forest. After a famine in 1931, there were possibly no more than 20 lions left but it was due to the foresight of the Nawabs of Junagadh that the species has been saved and at present, there are 359 lions (Gujarat forest department census report 2006). The improvement was mainly due to the effective protective measures taken by the Government of Gujarat.

The core area of the park has been converted into a national park, the illegal grazing by cattle within boundary limits has been greatly reduced and this has enabled the prey species to multiply. Because the Asiatic lion is now located in only one small area within the country, it is obviously in a very vulnerable position and attempts are being made to translocate a few of these lions into another area so that a second home for this endangered species is established. At present, the Palpur-Kuno sanctuary of Madhya Pradesh has been considered as an option.
Best time to visit: December-March and is closed during the monsoon until mid-October.

Indian Gaur

6. Kanha National Park

Location: Part of the Central Indian highlands, which stretch across Madhya Pradesh from west to east.
Established in: 1879 as a reserved forest and then as the Banjar Valley Sanctuary in 1935 and as the Kanha National Park in June 1955. In 1972, it became one of the Tiger Reserves under Project Tiger.
Area: 1,945 sq.km.
Introduction: It is a large amphitheatre of meadow-like grasslands surrounded by flat-topped hills. Its altitude varies from 500 to 1,000 m asl. The wet season begins in late June and ends in October, producing about 1,800 mm of rainfall and this is followed by a cool season from November to February and a hot season from then, until the monsoon arrives. The tree cover consists mainly of Sal interspersed with various species of *Terminalia*. There are occasional patches of bamboos and thickets.

About half the park is covered by dry deciduous woodland consisting of axle wood, kanchan, and amaltas. The wildlife includes Tiger, Panther, Dhole, Hyena, Sloth Bear, Jackal, Civets, Boar, Chital, Swamp Deer, Sambar, Mouse Deer, Black Buck, Four-horned Antelope, Nilgai, Gaur and Hanuman Langur. Kanha is possibly the best place in India for the viewing of tigers. Some of the animals are not shy of tourists on elephant-back and they allow an approach within a few feet in the certainty that they will not be harmed.
Best time to visit: December-March and is closed from July-November.

7. Kaziranga National Park

Location: In a low-lying area between the Brahmputra River and Mikir hills in Assam.
Established in: 1908 as a game reserve and in 1974 was designated as a national park. It has been included in Project Tiger since 1972. It is also one of the world heritage sites.
Area: 471.71 sq.km.
Introduction: Kaziranga has been declared as one of our most impressive wildlife reserves and it is largely because of Kaziranga that the Great Indian Rhinoceros has survived. Viewing the rhinoceros from elephant-back is one of the highlights of visiting the national park.

Wild Buffalo

Swamp deer and wild buffalo population has increased significantly. The vegetation is typical of swampland in north India in which the water hyacinth has become established. There are large pools fringed with reeds and patches of tall grassland. Trees and thickets consist mainly of white iris, hickory, lendi as well *Jarul*. The larger animals include the Tiger, Leopard, Elephant, Wild Boar, Capped Langur, Hoolock Gibbon, Hog Deer, Swamp Deer and Wild Buffalo.

Kaziranga is rich in bird life, which includes grey pelicans, black-necked storks, lesser adjutant stork and numerous species of waterfowl. The forested hill slopes have a good numbers of butterflies including the golden birdwing and common birdwing.
Best time to visit: December-March.

Great Indian Rhinoceros

8. Keoladeo National Park

Location: Bharatpur, Rajasthan.
Established in: 1956 as sanctuary and national park in 1981. Earlier it was a shooting reserve of the Maharaja of Bharatpur. It is also one of the world heritage sites.
Area: 28.73 sq.km.
Introduction: A well-known water-bird sanctuary in Asia, famous for several hundred varieties of birds, both migratory as well as resident. It is less than 200 m asl. A narrow tar road bisects it and the entire area is divided into small compartments by boundary roads, which are motorable. Through a system of gates, the depth of the water is maintained at about 1.5 m in the interests of the various types of waterfowl.

The vegetation belongs to the tropical dry deciduous type and the sanctuary is covered with shrubs and medium-sized trees consisting of *babul*, *khejri*, *ber*, *jamun* and others. Several of the trees, such as *babul*, are well adapted to survive under extreme conditions. They do well when the lake is at high-water mark and surrounded by several feet of water; equally well in drought periods when the ground around them is totally dry. It is on these trees that Egret, Herons, Cormorants, Darters, Spoonbills, and other birds nest during the monsoon period.

More than 300 species of birds are found within the sanctuary, the largest congregation being of migratory ducks. Some indication of the numbers can be gauged from the fact that in 1938 the Viceroy and his party shot 4,273 birds in a single day.

Once this was the only known wintering ground of the Siberian Crane in India. Though Keoladeo is famous as a bird sanctuary, it has a wide variety of mammals, including the Rhesus Macaque, Hanuman Langur, Chital, Sambar, Hog Deer, Nilgai, Porcupine, Boar, Fox, Jackal, Civets, Fishing Cat, Leopard Cat, Jungle Cat and Otter. This sanctuary lies amidst surroundings which have been totally denuded of all vegetation, and consequently there is great pressure on its ecosystem because of grazing by cattle and buffaloes and the illicit cutting of trees.
Best time to visit: This sanctuary is open throughout the year but it is best during breeding season of birds i.e. July-October and migratory season from November-February.

9. Barren Island Sanctuary

Location: Approximately 60 km east of the main Andaman group of islands, Bay of Bengal. It is about 125 km northeast of Port Blair.
Established in: 1987
Area: 8.10 sq.km.
Introduction: It is one of the 105 islands protected due to the unique flora and fauna they support. It consists of little closed forest cover around an isolated volcano. The temperature ranges from 20°-30°C with rainy season from June to December. The waters around the island are home to dolphins and dugongs.
Best time to visit: January-March.

Dolphin

10. Melghat Tiger Reserve

Location: In the Amravati District of Maharashtra. It forms a part of the southern section of the Satpura Range known as the Gavilgarh hills.
Established in: 1985
Area: 1,150.03 sq.km.
Introduction: Melghat means `the meeting place of ghats' and as the name signifies, it consists of steep hills and valleys. It has some of the finest dry deciduous teak forests of our area and other prominent species are haldu, axle wood, laurel and kadam. The highest point of the sanctuary is 992 m asl and lowest 381 m.

Chital

The temperature varies significantly between the day and the night and it is not common to get a chilly night after scorching heat in the afternoon. In May, the temperature goes up to 43°C while in January the minimum is about 12°C. Within the Reserve itself there are wide variations in rainfall ranging from a 1,000 mm to 2,250 mm.

Melghat was a favourite tiger shooting area until it became part of Project Tiger in 1972. Apart from tigers, other animals to be seen are the Rhesus Macaque, Langur, Gaur, Four-horned Antelope, Nilgai, Sambar, Chital, Wild Boar, Porcupine, Hare, Panther, Dhole, Sloth Bear, Jungle Cat, Civets, Fox, Hyena and Jackal. There is rich bird life including forest dwelling species such as the Great Horned Owl and birds found near water such as Stork-Billed kingfisher.
Best time to visit: January-June.

Elephants

11. Mudumalai National Park

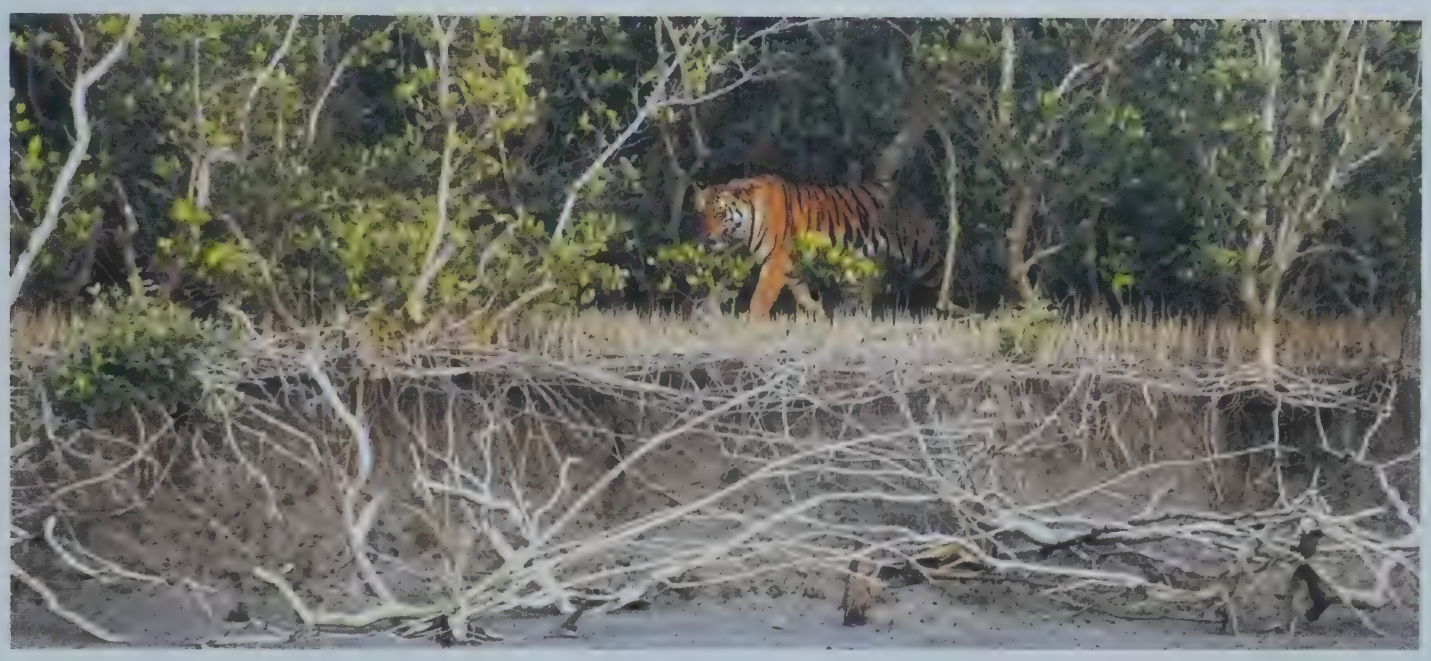
Location: In the Nilgiri District of Tamil Nadu.
Established in: 1940 as sanctuary and as a national park in 1990.
Area: Initially with an area of only 62 sq.km. and at present, it covers an area of 321 sq.km.
Introduction: Madumalai has an impressive range of landscapes and vegetation types, open grasslands, swampland, well-clothed hill ranges and undulating parkland. The western part has rich tree growth while in the eastern part there is scrub jungle. There are thorn forests on the eastern side of the plateau at the foot of the Nilgiris. There is considerable movement of animals in this vital wildlife corridor area and the clear days from January to early April are most rewarding for wildlife enthusiasts. It is connected to the Bandipur National Park in Karnataka.

From the natural history point of view, its location at the base of the Nilgiri range and with an altitude varying from 850 to 1,250 m is significant. It contains many forms of life peculiar to the plains as well as to the hills. Moyar Betta is the highest peak in the park and the lowest altitude is at the picturesque Moyar waterfalls. Mudumalai is reasonably well organized. The well-planned paths are best traversed by jeep or open vans, while elephant-back is advised for areas with tall grass and along streambeds. Several trails skirt waterholes where plenty of animal activity can be seen.

The wildlife includes a good number of Elephant, Tiger, Leopard, Jungle Cat, Toddy Cat, Leopard Cat, Jackal, Striped Necked and Common Mongoose, Sloth Bear, Dhole, Ratel, Fishing Cat, Pangolin, Malabar Civet, Four-horned Antelope, Hyena, Wild Boar, Hanuman and Bonnet Monkeys, Malabar and Flying Squirrels. There are well over 120 species of resident and migratory birds. Despite a wealth of species, this park is struggling to survive against the demands of human settlements, cattle grazing, forest fires, developmental projects and a busy highway, protecting this area remains a challenging task.
Best time to visit: March-June and September-October.

12. Sundarbans National Park

Location: In the South 24 Parganas district in West Bengal.
Established in: 1984
Area: 2,585.10 sq.km.



Introduction: Sundarbans is also a Tiger Reserve that covers a vast region of mangrove swamp, forested islands and small rivers near the Bay of Bengal. Most of the area is estuarine mangrove forest and swamp supporting an ecosystem specially adapted to high salinity. The park holds more tigers than any other tiger reserve. The best way to move around is to board a motor boat at Canning, Basanti, Gosaba or Sonakhali. Sundarbans tiger is well adapted to the high salinity of the waters and has become almost amphibious. Boat trips can be exciting, providing glimpses of Gangetic dolphins, Clawless Otters, Estuarine Crocodiles, Water Monitor and several kinds of turtles including, perhaps, the endangered river terrapin. Human presence has been limited to honey and wood collectors and people engaged in procuring minor forest produce. As a result, it has remained a comparatively pristine area providing adequate cover for wildlife. Ensuring the survival of the complex Sundarbans' forests and its wildlife is paramount, to our own survival. It is a coastal stabilizer, taming the hostile world of tides and waves to protect the hinterland.

The meeting place of water and land is usually an area of high productivity and so is the case with the Sundarbans. Diverse forms of life exist here including a variety of fish, shells, crabs and shrimps. High tides occur twice a day. Its a perfect place to see eight species of Kingfishers; Common Kingfisher, Brown-winged Kingfisher, Stork-billed Kingfisher, Ruddy Kingfisher, White-throated Kingfisher, Black-capped Kingfisher, Collared Kingfisher and Pied Kingfisher. Besides good number of migratory waterfowl is seen in winter.

Apart from the Tiger, the Sundarbans has good numbers of Rhesus Macaque, Wild Boar and Chital. The Javan Rhinoceros, Swamp Deer and the Wild Buffalo, which were once a feature of the place, have unfortunately become extinct.

Best time to visit: December-early April.

LEGAL PROTECTION TO PROTECTED AREAS

1. Indian Wildlife Protection Act

All our protected areas enjoy legal protection under the Wildlife Protection Act. The Directive Principles of State Policy of the Indian Constitution in clear and unambiguous terms states that:

"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country".

Environmental protection is also enshrined as a fundamental duty of every citizen of India - "to protect and improve the natural environment, including forests, lakes, rivers and wildlife, and to have compassion for living creatures".

The Wildlife (Protection) Act, 1972, is a comprehensive Central legislation affording legal measures for the protection of wild plant and animals including birds, reptiles, amphibians, insects and endangered species in particular. It also provides for the setting up of national parks and wildlife sanctuaries, regulation of trade or commerce in wildlife, products, trophies and more.

There are five schedules in the Act such as I, II, III, IV, V which list the rare and endangered species that need total protection; special game species, which deserve stringent protection for which licenses can be issued under special circumstances and more.

The provisions of the Act have been amended from time to time. A major amendment came into effect on 2 October 1991, which provides for greater protection to wildlife and stringent punishment for violations, enabling individuals to take instances of violations of the Act directly to the courts. Section 9 of the Act prohibits hunting of all wildlife specified in Schedules I, II, III and IV of the Act. There are also stricter provisions and procedures to deal with stocks of wildlife articles held by dealers, transportation of wildlife, deterrent punishment to poachers and more.

2. CITES

The Convention on International Trade in Endangered Species of wild fauna and flora (CITES), which came into effect in 1975, aims at preventing international trade in wild fauna and flora. India is a signatory to this convention. The signatories have unanimously agreed:

- That wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth;
- That they are conscious of the ever-growing value of wild fauna and flora from aesthetic, scientific, cultural, recreational and economic points of view;
- That people and states are and should be the best protectors of their own wild fauna and flora;
- That international cooperation is essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade; and
- That there is an urgency in taking appropriate measures to this end.

Species under trade have been categorized into Appendices I, II and III in decreasing order of the threat, respectively.

IUCN Red List

3. World Conservation Union (formerly IUCN)

The International Union for the Conservation of Nature and Natural Resources (IUCN) is an international organization consisting of states, government departments, international entities such as UNESCO and UNEP as well as private conservation organizations. Its broad purpose is to foster the maintenance of the biosphere and its diversity by rational management of the Earth's resources. It was established in 1948 at an international conference at Fontainebleau, which was sponsored by UNSECO and the Government of France. The Union's headquarters are located in Gland, near Geneva, in Switzerland.

The IUCN operates through several permanent missions, which includes Species' Survival, National Parks and Protected Areas, the Ecology Commission, Education Commission, Environmental Planning and others. It has produced the Red Data Books on endangered species of animals, birds and plants.

4. Biological Diversity Act, 2002

Biodiversity encompasses the variety of all life on Earth. India is one of the 12-mega diverse countries of the world. With only 2.5% of the land area of the world, India already accounts for 7.8% of the global recorded species. India is also rich in traditional and indigenous knowledge, both coded and informal.

India is a party to the Convention on Biological Diversity (CBD, 1992).Recognizing the sovereign rights of States to use their own biological resources, the Convention expects the parties to facilitate access to genetic resources by other parties subject to national legislation and on mutually agreed upon terms (Article 3 and 15 of CBD). Article 8(j) of CBD recognizes contributions of local and indigenous communities to the conservation and sustainable utilization of biological resources through traditional knowledge, practices and innovations and provides for equitable sharing of benefits with such people arising from the utilization of their knowledge, practices and innovations.

Biodiversity is a multi-disciplinary subject involving diverse activities and actions. The stakeholders in biological diversity include the Central Government, State Governments, institutions of local self-governmental organizations, industry and more. One of the major challenges before India lies in adopting an instrument, which helps realise the objectives of equitable sharing of benefits enshrined in CBD.

White-backed vulture

Vulture breeding center

After an extensive and intensive consultation process involving the stakeholders, the Central Government has brought Biological Diversity Act,2002 with the following salient features:-

- To regulate access to biological resources of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources; and associated knowledge relating to biological resources
- To conserve and sustainably use biological diversity
- To respect and protect knowledge of local communities related to biodiversity
- To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources
- Conservation and development of areas of importance from the standpoint of biological diversity by declaring them as biological diversity heritage sites
- Protection and rehabilitation of threatened species eg. White-backed vultures
- Involvement of institutions of state governments in the broad scheme of the implementation of the Biological Diversity Act through constitution of committees

SPECIAL WILDLIFE PROJECTS

1. Gir Sanctuary Project

The Asiatic lion, which once existed in the northern and central areas of the Indian sub-continent, is now confined to the Gir forest of Gujarat. This last remaining habitat of the species is under severe threat due to over-grazing by domestic livestock, depletion of prey species and more. The Asiatic lion was in danger of being wiped out either due to starvation, epidemics or human interference. In 1972, the state government prepared a scheme for the management of the Gir sanctuary with proper guidelines for conservation. The Centre provided assistance for the protection and improvement of the habitat. Current population is 359.

2. Project Tiger

Considering the fast decline of the tiger population in the country, a special task force was set up in 1970 by the Indian Board for Wildlife to prepare an action plan for conserving the tiger population in India. As a result, Project Tiger was launched on 1 April 1973 with the following objectives:

- To ensure maintenance of a viable population of tigers in India for scientific, economic, aesthetic, cultural and ecological values;
- To preserve, for all times, areas of biological importance as a national heritage for the benefit, education and enjoyment of the people.

Tiger

In 1973-74, nine tiger reserves were established based on the following principles:

- Elimination of all forms of human exploitation and disturbance from the core area as well as rationalization of such activities in the buffer area.
- Limitation of habitat management to repair the damage done by man with the aim of restoring the ecosystem as close to its natural functioning as possible; and
- Researching facts about habitat and wild animals and carefully monitoring changes in flora and fauna.

Starting from nine reserves in 1973-74 the number is grown up to twenty nine in 2006 throughout the country *(See table, courtesy Wildlife Institute of India)*

Project Tiger represents the country's commitment to protection of wildlife and is recognized today as a conservation success story. A steering committee under the chairmanship of the Prime Minister provides guidelines to the management of the tiger reserves. The project has ensured the protection of entire ecosystems required for the habitat of the tiger and over the year, their population has more than doubled. Current population is 1,706.

List of Tiger Reserves in India

State	Tiger Reserve	Year of Estd.	Total Area (km^2)
Assam	1. Kaziranga	2006	859
	2. Manas	1973-74	2840
	3. Nameri	1999-2000	344
Arunachal Pradesh	4. Namdapha	1982-83	1985
	5. Pakhui	1999-2000	862
Andhra Pradesh	6. Nagarjunsagar-Srisailam	1982-83	3568
Bihar	7. Valmiki	1989-90	840
Chhattishgarh	8. Indravati	1982-83	2799
Jharkhand	9. Palamau	1973-74	1026
Karnataka	10. Bandipur Nagarhole	1973-74	866
	(extension)	1999-2000	643
	11. Bhadra	1998-99	492
Kerala	12. Periyar	1978-79	777
Madhya Pradesh	13. Bandhavgarh	1993-94	1162
	14. Bori-Satpura	1999-2000	1486
	15. Kanha	1973-74	1945
	16. Panna	1994-95	542
	17. Pench	1992-93	758
Maharashtra	18. Melghat	1973-74	1677
	19. Pench	1992-93	257
	20. Tadoba-Andhari	1993-94	620
Mizoram	21. Dampa	1994-95	500
Orissa	22. Simlipal	1973-74	2750
Rajasthan	23. Ranthambhore	1973-74	1334
	24. Sariska	1978-79	866
Tamil Nadu	25. Kalakad- Mundathurai	1988-89	800
Uttar Pradesh	26. Dudhwa Katerniaghat	1987-88	811
	(extension)	1999-2000	551
Uttaranchal	27. Corbett	1973-74	1316
West Bengal	28. Buxa	1982-83	759
	29. Sunderbans	1973-74	2585
		Total Area	38,620

3. Himalayan Musk Deer Project

The musk deer, which was once found throughout the Himalayan region, has been persecuted by man for its musk used in the preparation of perfumes and medicines. This coupled with habitat destruction brought about a sharp decline in its population. A conservation project was therefore launched in the Kedarnath sanctuary (Uttarakhand), under the Threatened Deer Programme of the IUCN with co-operation of the Government of India. Current population is less than 5,000.

Himalayan Musk Deer

4. Project Hangul

Hangul

The Kashmir stag or hangul is an endangered mammal, now limited in distribution at the Dachigam sanctuary and in some other small pockets of Jammu & Kashmir and Himachal Pradesh. Habitat destruction, over-grazing by domestic cattle and sheep and poaching reduced their number to less than 200 by the year 1970. Under joint collaboration with the IUCN and the World Wide Fund for Nature (WWF), Jammu & Kashmir state took up a project for the protection and conservation of this animal, called Project Hangul in 1970. This has yielded promising results and population of the deer increased to over 340 by the year 1980. Current population is 217.

5. Crocodile Breeding Project

The Gharial, the Mugger and the Estuarine Crocodile - the three species of crocodilians found in India became very rare by the early 1970s. With the assistance of the United Nations Development Programme (UNDP), the Government of India launched a crocodile breeding and management project, initially in Orissa in the year 1975. The scheme was subsequently extended to Uttarakhand, Rajasthan, West Bengal, Tamil Nadu, Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Andamans, Assam, Bihar and Nagaland. Because of the breeding projects and their management in 12 sanctuaries, the population of all three species has considerably increased. Presently, due to the overwhelming breeding success, forest departments have concluded captive breeding of the mugger.

Crocodile Breeding Center

CODE OF CONDUCT

When visiting any national park or wildlife sanctuary, please observe all rules listed below:

1. Carry a brochure or handout of the respective park or sanctuary.
2. Wear dull coloured clothes such as grey, brown, green, black and khaki.
3. Carry a notepad, pen, water bottle, cap, camera and binoculars in a small rucksack.
4. Maintain silence and talk softly.
5. Tread lightly on the land. Take care not to trample on saplings or small bushes.
6. Keep away from wasp's nest and beehives.
7. Take precautions against snakes and scorpions and avoid going in thickets.
8. Carry a first-aid box.
9. Report any violations or damage of park resources to the park ranger.
10. Carry your park manners back to daily life. Do not, for instance, dump leftover household chemicals into the environment or throw debris into the water wherever you are, it's somebody's home.

1. Carry weapons or firearms of any type.
2. Hunt wild animals.
3. Feed any wildlife. Feeding animals in national parks is illegal. Feeding can make them dependent, unable to take care of themselves in the wild. For all these reasons, keep a respectful distance.
4. Approach too closely or harass any wildlife. You should be sensitive to the needs of animals. Close approach may cause them stress and disrupt feeding, breeding, or other activities. Watching with binoculars is the considerate and easy way. Remain quiet. Do not disturb nests or dens.
5. Disturb any plants or animals, including plucking flowers.
6. Imitate bird or animal calls.
7. Remove, displace, or destroy any object within the park, including rocks, wood and other natural features.
8. Litter. Trash must be packed and taken out if no litter containers are available.
9. Drive slowly to avoid wildlife accidents. Moreover, the Park roads are designed for sightseeing.
10. Carry pets on trails.
11. Smoke on trails or inside buildings.
12. Move alone.
13. Light a fire.

14. Play music systems.
15. Behave in an excessively loud or unruly conduct. Remember, many people travel long distances to national parks to enjoy solitude in the wilderness.
16. Keep idle cars while stopped at pullouts. Besides wasting fuel, it also produces unnecessary air and noise pollution - things not wanted especially in a national park by visitors or animals.

These rules are a good template for responsible conduct no matter where you visit. These parks and sanctuaries are being reserved often for some rare and endangered animals. We cannot afford to lose any of these special animals. Any additional threat to them caused by people coming to see the park is a tragic irony, considering the parks were established to protect these animals in the first place.

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.

by Aldo Leopold

WE CAN MAKE A DIFFERENCE

Make a Mini Wildlife Reserve

One way to save wildlife is to create national parks and nature reserves. These provide safe places for animals and plants to live and breed. Why not make your own mini wildlife reserve?

A garden wildlife reserve is good fun and you can learn a lot by watching the animals that move into it. If you don't have a garden at home, you could encourage your school to start a mini wildlife reserve in a quiet corner on the school grounds.

Here are some ideas to start you off. Even if you only use one or two of them you will make the area more welcoming to wildlife.

Poinsettia and Marigold are easy to grow and their flowers attract bees, butterflies and other insects. Hamelia attracts good numbers of butterflies as well as birds. Hedges of bitter hedge will not only attract moths with its sweet scented flowers, but will also invite smaller birds such as sunbirds and flycatchers to make their nests. Lantana flowers are good source of nectar for both butterflies and birds. If you don't want the lantana to spread, plant them in large pots or buckets.

Log piles attract a number of small beasts and often-larger creatures too, such as carpenter bees, wood-boring beetles, geckos, skinks, toads and shrews. Make a small heap of rotting logs in one corner of your wildlife reserve. Cover part of it with dead leaves. You won't have to wait for long to see the results.

Build a bird table and put out bread, seeds, fruits and nuts for birds and insects to eat in winter. Remember to provide a supply of fresh, clean water for them to drink and bathe in. An upturned dustbin lid makes a good birdbath.

Make a mini-pond by sinking an old bowl or plastic container into the ground, away from direct sunlight, and filling it with sand, gravel and a few larger stones. Then add water and pondweed. Use pond water if you can; tap water is suitable as long as you let it stand for a few days to let the chlorine disappear.

Remember, wildlife gardeners do not use chemical pesticides and fertilizers. Make a compost heap of your kitchen waste, leaf litter and other biodegradable refuse. Use the compost to help your plants to grow.

LIST OF NATIONAL PARKS (NP) AND WILDLIFE SANCTUARIES (WLS)

State/UT	No. of NP	No. of WLS	Total Protected Area's
Andhra Pradesh	6	21	27
Arunachal Pradesh	2	11	13
Assam	5	18	23
Bihar	1	12	13
Chhattisgarh	3	11	14
Goa	1	6	7
Gujarat	4	23	27
Haryana	2	8	10
Himachal Pradesh	2	33	35
Jammu & Kashmir	4	15	19
Jharkhand	1	11	12
Karnataka	5	21	26
Kerala	6	15	21
Madhya Pradesh	9	25	34
Maharashtra	6	35	41
Manipur	1	1	2
Meghalaya	2	3	5
Mizoram	2	8	10
Nagaland	1	3	4
Orissa	2	18	20
Punjab	0	12	12
Rajasthan	5	25	30
Sikkim	1	7	8
Tamil Nadu	5	21	26
Tripura	2	4	6
Uttar Pradesh	1	23	24
Uttarakhand	6	6	12
West Bengal	5	15	20
Union Territories (UT)			
Andaman & Nicobar	9	96	105
Chandigarh	0	2	2
Dadra & Nagar Haveli	0	1	1
Daman & Diu	0	1	1
Delhi	0	1	1
Lakshadweep	0	1	1
Pondicherry	0	1	1
Total	99	514	613

LIST OF NATIONAL PARKS AND SANCTUARIES (Courtesy Wildlife Institute of India)

[1] ANDAMAN & NICOBAR ISLANDS

National Parks (NP)

1. Campbell Bay NP
2. Galathea Bay NP
3. Mahatama Gandhi Marine NP
4. Rani Jhansi Marine NP
5. Middle Button Island NP
6. Mount Harriett NP
7. North Button Island NP
8. Saddle Peak NP
9. South Button Island NP

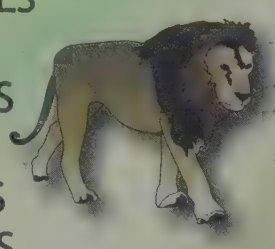
Wildlife Sanctuaries (WLS)

1. Arial Island WLS
2. Bamboo Island WLS
3. Barren Island WLS
4. Battimalv Island WLS
5. Belle Island WLS
6. Bennett Island WLS
7. Bingham Island WLS
8. Blister Island WLS
9. Bluff Island WLS
10. Bondoville Island WLS
11. Brush Island WLS
12. Buchanan Island WLS
13. Channel Island WLS
14. Cinque Islands WLS
15. Clyde Island WLS
16. Cone Island WLS
17. Curlew Island (B.P.)WLS
18. Curlew Island WLS
19. Cuthbert Bay WLS
20. Defence Island WLS
21. Dot Island WLS
22. Dottrell Island WLS
23. Duncan Island WLS
24. East of Inglis Island WLS
25. East Island
26. Egg Island WLS
27. Elat Island WLS
28. Entrance Island WLS
29. Gander Island WLS
30. Girjan Island WLS
31. Glathea Bay WLS
32. Goose Island WLS
33. Hump Island WLS
34. Interview Island WLS
35. James Island WLS
36. Jungle Island WLS
37. Kwantung Island WLS
38. Kyd Island WLS
39. Landfall Island WLS
40. Latouche Island WLS
41. Lohabarrack WLS
42. Mangrove Island WLS
43. Mask Island WLS
44. Mayo Island WLS
45. Megapode Island WLS
46. Montogemery Island
47. Narcondam Island WLS
48. North Brother Island WLS
49. North Island WLS
50. North Reef Island WLS
51. Oliver Island WLS
52. Orchid Island WLS
53. Ox Island WLS
54. Oyster Island-I WLS
55. Oyster Island-II WLS
56. Paget Island WLS
57. Parkinson Island WLS
58. Passage Island WLS
59. Patric Island WLS
60. Peacock Island WLS
61. Pitman Island WLS
62. Point Island WLS
63. Potanma Island WLS
64. Ranger Island WLS
65. Reef Island WLS
66. Roper Island WLS
67. Ross Island WLS
68. Rowe Island WLS
69. Sandy Island WLS
70. Sea Serpent Island WLS
71. Shark Island WLS
72. Shearme Island WLS
73. Sir Hugh Rose Island WLS
74. Sisters Island WLS
75. Snake Island- I WLS
76. Snake Island -II WLS
77. South Brother Island WLS
78. South Reef Island WLS
79. South Sentinel Island WLS
80. Spike Island- I WLS
81. Spike Island- II WLS
82. Stoat Island WLS
83. Surat Island WLS
84. Swamp Island WLS
85. Table (Delgarno) Island WLS
86. Table (Excelsior) Island WLS
87. Talabaicha Island WLS
88. Temple Island WLS
89. Tillongchang Island WLS
90. Tree Island WLS
91. Trilby Island WLS
92. Tuft Island WLS
93. Turtle Islands WLS
94. West Island WLS
95. Wharf Island WLS
96. White Cliff Island WLS

[2] ANDHRA PRADESH

National Parks (NP)

1. Kasu Brahmananda Reddy NP
2. Mahaveer Harina Vanasthali NP
3. Mrugavani NP
4. Sri Venkateswara NP



Wildlife Sanctuaries(WLS)

1. Coringa WLS
2. Eturnagaram WLS
3. Gundla Brahmeshwaram WLS
4. Kaundinya WLS
5. Kawal WLS
6. Kinnerasani WLS
7. Kolleru WLS
8. Krishna WLS
9. Lanja Maddugu Sivaram WLS
10. Manjira WLS
11. Nagarjunsagar-Srisailam WLS

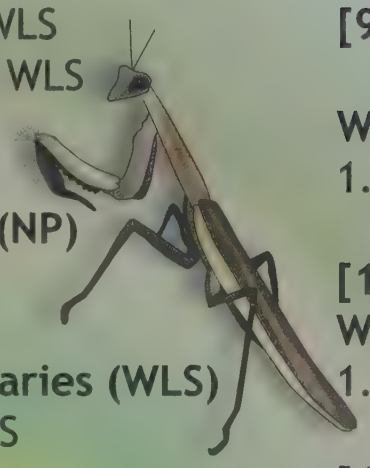
12. Nellapattu WLS
13. Pakhal WLS
14. Papikonda WLS
15. Pocharam WLS
16. Pranahita WLS
17. Pulicat Lake WLS
18. Rollapadu WLS
19. Sri Lakamalleshwaram WLS
20. Sri Penusila Narasimha WLS
21. Sri Venkateshwara WLS

[3] ARUNACHAL PRADESH
National Parks (NP)
1. Mouling NP
2. Namdapha NP

Wildlife Sanctuaries (WLS)
1. D'Ering Memorial WLS
2. Dibang WLS
3. Eagle Nest WLS
4. Itanagar WLS
5. Kamlang WLS
6. Kane WLS
7. Mehao WLS
8. Pakhui WLS
9. Sessa Orchid WLS
10. Tale Valley WLS

[4] ASSAM
National Parks (NP)
1. Dibru-Saikhowa NP
2. Kaziranga NP
3. Manas NP
4. Nameri NP
5. Orang NP

Wildlife Sanctuaries (WLS)
1. Bardoibum-Beelmukh WLS
2. Barnodi WLS
3. Burachaporl WLS
4. Chaakrasil WLS
5. Diparbeel WLS
6. Garampani WLS
7. Gibbon WLS
8. Laokhowa WLS
9. Pabitora WLS
10. Padumani-Bherjan-Borajan WLS
11. Panidihing WLS
12. Sonal-Rupai WLS



[5] BIHAR
National Parks (NP)
1. Valmiki NP

Wildlife Sanctuaries (WLS)
1. Barela S.A.Z.S
2. Bhimbandh
3. Gautam Budha WLS
4. Kanwarjheel WLS
5. Kaimur WLS
6. Nagi Dam WLS
7. Nakti Dam WLS
8. Rajgir WLS
9. Udaypur WLS
10. Valmiki WLS
11. Vikramshila Gangetic Dolphin WLS

[6] CHANDIGARH
National Parks (NP)
1. Sukhna Lake WLS

[7] CHATTISGARH
National Parks (NP)
1. Indravati NP
2. Kangerghati NP
3. Sanjay NP

Wildlife Sanctuaries (WLS)
1. Achanakmar WLS
2. Badalkhol WLS
3. Barnawapara WLS
4. Bhairamgarh WLS
5. Gomardha WLS
6. Pamed WLS
7. Semarsot WLS
8. Sitanadi WLS
9. Tamorphingla WLS
10. Udanti WLS

[8] DAMAN & DIU
Wildlife Sanctuaries (WLS)
1. Fudam WLS

[9] DADRA & NAGAR HAVELLI
Wildlife Sanctuaries (WLS)
1. Dadra & Nagar Haveli WLS

[10] DELHI
Wildlife Sanctuaries (WLS)
1. Indira Priyadarshini WLS

[11] GOA
National Parks (NP)
1. Mollem NP

Wildlife Sanctuaries (WLS)
1. Bondla WLS
2. Chorao Island (Dr. Salim Ali) WLS
3. Cotigaon WLS
4. Madei WLS
5. Bhagvan Mahavir WLS
6. Netravali WLS

[12] GUJARAT
National Parks (NP)
1. Bansda NP
2. Gir NP
3. Marine (Gulf of Kachchh) NP
4. Blackbuck NP

Wildlife Sanctuaries (WLS)
1. Balaram Ambaji WLS
2. Barda WLS
3. Gaga Great Indian Bustard WLS
4. Gir WLS
5. Hingolgarh Nature Reserve WLS
6. Jessore WLS
7. Jumbogodha WLS
8. Lala Great Indian Bustard WLS

9. Kachchh Desert WLS
10. Khijadiya WLS
11. Marine (Gulf of Kachchh) WLS
12. Nal Sarovar WLS
13. Narayan Sarovar WLS
14. Paniya WLS
15. Porbandar Lake WLS
16. Purna WLS
17. Rampura Vidi WLS
18. Ratanmahal WLS
19. Shoolpaneshwar WLS
20. Thol Lake WLS
21. Wild Ass WLS

[13] HARYANA
National Parks (NP)
1. Sultanpur NP

Wildlife Sanctuaries (WLS)
1. Abubshehar WLS
2. Bhindawas WLS
3. Bir Bara Ban WLS
4. Bir Shikargarh WLS
5. Chhilchila WLS
6. Kalesar WLS
7. Khaparwas WLS
8. Nahar WLS
9. Saraswati Plantation WLS

[14] HIMACHAL PRADESH
National Parks (NP)
1. Great Himalayan NP
2. Pin Valley NP

Wildlife Sanctuaries (WLS)
1. Bandli WLS
2. Chail WLS
3. Churdhar WLS
4. Daranghati WLS
5. Darlaghat WLS
6. Dhauladhar WLS
7. Gamgul Siahbehi WLS
8. Govind Sagar WLS
9. Kais WLS
10. Kalatop-Khajjiar WLS
11. Kanawar WLS
12. Khokhan WLS
13. Kibber WLS
14. Kugti WLS
15. Lippa Asrang WLS
16. Majathal WLS
17. Manali WLS
18. Naina Devi WLS
19. Nargu WLS
20. Pong Dam Lake WLS
21. Renuka WLS
22. Rupi Bhaba WLS
23. Sainj WLS
24. Sangla WLS
25. Sechu Tuan Nala WLS
26. Shikari Devi WLS
27. Shilli WLS
28. Shimla Water Catchment WLS
29. Simbalbera WLS
30. Talra WLS
31. Tirthan WLS
32. Tundah WLS

[15] JAMMU & KASHMIR
National Parks (NP)
1. City Forest NP
2. Dachigam NP
3. Hemis NP
4. Kistwar NP

Wildlife Sanctuaries (WLS)
1. Baltal-Thajwas WLS
2. Changthang WLS
3. Gulmarg WLS
4. Hirapora WLS
5. Hokersar WLS
6. Jasrota WLS
7. Karakoram WLS
8. Lachipora WLS
9. Limber WLS
10. Nandini WLS
11. Overa WLS
12. Overa-Aru WLS
13. Ramnagar Rakha WLS
14. Surinsar Mansar WLS
15. Trikuta WLS

[16] JHARKHAND
National Parks (NP)
1. Betla NP

Wildlife Sanctuaries (WLS)
1. Dalma WLS
2. Hazaribagh WLS
3. Koderma WLS
4. Lawalong WLS
5. Mahauaduar WLS
6. Palamau WLS
7. Palkot WLS
8. Parasnath WLS
9. Topchanchi WLS
10. Udhwa Lake WLS

[17] KARNATAKA
National Parks (NP)
1. Anshi NP
2. Bandipur NP
3. Bannerghatta NP
4. Kudremukh NP
5. Nagarahole NP

Wildlife Sanctuaries (WLS)
1. Adichunchunagriri WLS
2. Arabithittu WLS
3. Bhadra WLS
4. Biligiri Rangaswamy Temple WLS
5. Brahmagiri WLS
6. Cauvery WLS
7. Dandeli WLS
8. Doraji Bear WLS
9. Ghataprabha WLS
10. Gudavi WLS
11. Melkote Temple WLS
12. Mookambika WLS
13. Nugu WLS
14. Pushpagiri WLS
15. Ranebennur WLS
16. Ranganthittu WLS
17. Sharavathi Valley WLS
18. Shettihalli WLS

19. Someshwara WLS
20. Talakaveri WLS

[18] KERALA
National Parks (NP)
1. Eravikulam NP
2. Periyar NP
3. Silent Valley NP

Wildlife Sanctuaries (WLS)
1. Aralam WLS
2. Chimmony WLS
3. Chinnar WLS
4. Idukki WLS
5. Neyyar WLS
6. Parambikulam WLS
7. Peechi-Vazhani WLS
8. Peppara WLS
9. Periyar WLS
10. Shendurney WLS
11. Thatteekadu WLS
12. Wayanad WLS

[19] MADHYA PRADESH
National Parks (NP)
1. Bandhavgarh NP
2. Fossil NP
3. Kanha NP
4. Madhav NP
5. Panna NP
6. Pench NP
7. Sanjay NP
8. Satpura NP
9. Van Vihar NP

Wildlife Sanctuaries (WLS)
1. Bagdara WLS
2. Bori WLS
3. Gandhi Sagar WLS
4. Ghatigaon WLS
5. Karera WLS
6. Ken Gharial WLS
7. Kheoni WLS
8. National Chambal WLS
9. Narsighgarh WLS
10. Nauradehi WLS
11. Orcha WLS
12. Pachmarhi WLS
13. Palpur-Kuno WLS
14. Panna WLS
15. Panpatha WLS
16. Pench WLS
17. Phen WLS
18. Ralamandal WLS
19. Ratapani WLS
20. Sailana WLS
21. Sanjay Dubri WLS
22. Sardarpur WLS
23. Singhori WLS
24. Son Gharial WLS
25. Veerangna Durgawati WLS

[20] MAHARASHTRA
National Parks (NP)
1. Gugamal NP
2. Navegaon NP
3. Pench NP
4. Sanjay Gandhi NP
5. Tadoba NP
6. Chandoli NP

Wildlife Sanctuaries (WLS)
1. Amba Barwa WLS
2. Andhari WLS
3. Aner Dam WLS
4. Bhamragarh WLS
5. Bhimashankar WLS
6. Bor WLS
7. Chaprala WLS
8. Deolgaon-Rehkuri WLS
9. Dhyanganga WLS
10. Gautala WLS
11. Great Indian Bustrad WLS
12. Jaikwadi WLS
13. Kalsubai WLS
14. Karnala WLS
15. Katepurna WLS
16. Koyana WLS
17. Lonar WLS
18. Marine (Malvan) WLS
19. Mayureswar Supe WLS
20. Melghat WLS
21. Nagzira WLS
22. Naigaon Mayur WLS
23. Nandur Madhameshwar WLS
24. Narnala WLS
25. Painganga WLS
26. Phansad WLS
27. Radhanagari WLS
28. Sagareshwar WLS
29. Tansa WLS
30. Tipeshwar WLS
31. Yawal WLS
32. Yedsi Ramlinghat WLS
33. Wan WLS
34. Karanja Sohol Black Buck WLS
35. Tungareshwar WLS

[21] MANIPUR
National Parks (NP)
1. Keibul-Lamjao NP

Wildlife Sanctuaries (WLS)
1. Yangoupokpi-Lokchao WLS

[22] MEGHALAYA
National Parks (NP)
1. Balphakram NP
2. Nokrek Ridge NP

Wildlife Sanctuaries (WLS)
1. Baghmara Pitcher Plant WLS
2. Nongkhyllem WLS
3. Siju WLS

[23] MIZORAM
National Parks (NP)
1. Murlen NP
2. Phawngpui Blue Mountain NP

Wildlife Sanctuaries (WLS)
1. Dampa WLS
2. Khawnglung WLS
3. Lengten WLS
4. Ngengpuri WLS

[24] NAGALAND
National Parks (NP)
1. Intanki NP

Wildlife Sanctuaries (WLS)
1. Fakim WLS
2. Puliebadze WLS
3. Rangapahar WLS

[25] ORISSA
National Parks (NP)
1. Bhitarkanika NP
2. Simlipal NP

Wildlife Sanctuaries (WLS)
1. Badrama WLS
2. Baisipalli WLS
3. Balukhand Konark WLS
4. Bhitarkanika WLS
5. Chandaka Dampara WLS
6. Chilka WLS
7. Debrigarh WLS
8. Gahirmata WLS
9. Hadgarh WLS
10. Karlapat WLS
11. Khalasuni WLS
12. Kotagarh WLS
13. Kuldiha WLS
14. Lakhari Valley WLS
15. Nandankanan WLS
16. Satkosia Gorge WLS
17. Simlipal WLS
18. Sunabeda WLS

[26] PUNJAB
Wildlife Sanctuaries (WLS)
1. Abohaar WLS
2. Bir Aishvan WLS
3. Bir Bunerheri WLS
4. Bir Dosanjh WLS
5. Bir Gurdialpura WLS
6. Bir Mehaswala WLS
7. Bir Motibaugh WLS
8. Harike Lake WLS
9. Takhni-Rehampur WLS
10. Bir Bhadson WLS

[27] RAJASTHAN
National Parks (NP)
1. Desert NP
2. Keoladeo Ghana NP
3. Ranthambore NP
4. Sariska NP

Wildlife Sanctuaries (WLS)
1. Bandh Baratha WLS
2. Bassi WLS
3. Darrah WLS
4. Jaisamand WLS
5. Jamwa Ramgarh WLS
6. Jawahar Sagar WLS
7. Kela Devi WLS
8. Kesarbagh WLS
9. Kumbhalgarh WLS
10. Mount Abu WLS
11. Nahargarh WLS
12. National Chambal WLS
13. Phulwari Ki Nal WLS
14. Ramgarh Vishdhari WLS
15. Sajjangarh WLS
16. Sariska WLS
17. Sawai Man Singh WLS
18. Shergarh WLS
19. Sitamata WLS
20. Tal Chhapper WLS
21. Tadgarh Raoli WLS
22. Van Vihar WLS
23. Bhensrodgarh WLS
24. Ramsagar WLS

[28] SIKKIM
National Parks (NP)
1. Khanchendzonga NP

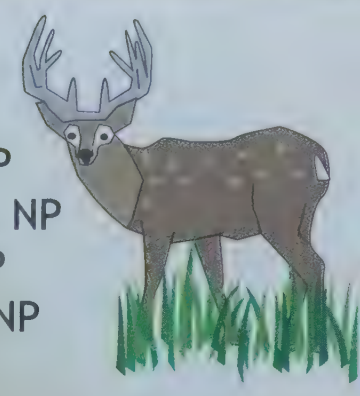
Wildlife Sanctuaries (WLS)
1. Barsey Rhododendron WLS
2. Fambong Lho WLS
3. Kyongnosla Alpine WLS
4. Maenam WLS
5. Shingba WLS

[29] TAMIL NADU
National Parks (NP)
1. Guindy NP
2. Gulf of Mannar Marine NP
3. Indira Gandhi (Annamalai) NP
4. Mudumalai NP
5. Mukurthi NP

Wildlife Sanctuaries (WLS)
1. Chitrangudi WLS
2. Indira Gandhi (Annamalai) WLS
3. Kalakad WLS
4. Kanjirankulam WLS
5. Karaivetti WLS
6. Karikilli WLS
7. Kilaselvanur-Melaselvanur WLS
8. Kuthankulam-Kadankulam WLS
9. Mudumalai WLS
10. Mundanthurai WLS
11. Point Calimere WLS
12. Pulicat Lake WLS
13. Srivilliputhur (Giant Squirrel) WLS
14. Udayamarthandapuram Lake WLS
15. Vaduvoor WLS
16. Vedanthangal WLS
17. Vellanadu WLS
18. Vettangudi WLS
19. Vellode WLS

[30] TRIPURA
Wildlife Sanctuaries (WLS)
1. Gumti WLS
2. Rowa WLS
3. Sepahijala WLS
4. Trishna WLS

[31] UTTARANCHAL
National Parks (NP)
1. Corbett NP
2. Gangotri NP



3. Govind NP
4. Nanda Devi NP
5. Rajaji NP
6. Valley of Flowers NP

Wildlife Sanctuaries (WLS)
1. Askot Musk Deer WLS
2. Binsar WLS
3. Govind Pashu Vihar WLS
4. Kedarnath WLS
5. Mussoorie WLS
6. Sonanadi WLS

[32] UTTAR PRADESH
National Parks (NP)
1. Dudhwa NP

Wildlife Sanctuaries (WLS)
1. Bakhira WLS
2. Chandraprabha WLS
3. Hastinapur WLS
4. Kaimur WLS
6. Kishanpur WLS
7. Lake Bahosi WLS
8. Mahavir Swami WLS
9. National Chambal WLS
10. Nawabganj WLS
11. Okhala WLS
12. Parvati Aranga WLS
13. Patna WLS
14. Ranipur WLS
15. Saman WLS
16. Samaspur WLS
17. Sandi WLS
18. Sohagibarwa WLS
19. Sohelwa WLS
20. Sur Sarovar WLS
21. Surha Tal WLS
22. Turtle WLS
23. Vijal Sagar WLS

[33] WEST BENGAL
National Parks (NP)
1. Buxa NP
2. Gorumara NP
3. Neora Valley NP
4. Singhalila NP
5. Sunderbans NP

Wildlife Sanctuaries (WLS)
1. Ballavpur WLS
2. Bethuadahari WLS
3. Bibhutibhusan WLS
4. Buxa WLS
5. Chapramari WLS
6. Haliday Island WLS
7. Jaldapara WLS
8. Jorepokhri Salamander WLS
9. Lothian Island WLS
10. Mahananda WLS
11. Narendrapur WLS
12. Raiganj WLS
13. Ramnabagan WLS
14. Sajnekhali WLS
15. Senchal WLS

A tiger is a large-hearted gentleman with boundless courage and that when he is exterminated - as exterminated he will be unless public opinion rallies to his support - India will be the poorer by having lost the finest of her fauna.

by Jim Corbett

Threatened Flora and Fauna

"There is nothing in nature to prove that it cares more for our human species than for daffodils. We may one day vanish as quickly and as radically as thousands of other breeds before us... Mother Nature has no mama's darlings. When the balance of nature is threatened, it always finds a way to restore that balance, at whatever cost. If endangered by us, nature will strike back and show no more concern for Michelangelo, Shakespeare or Mozart than for daffodils. We are dealing here with an overwhelming force, that of life itself and we know next to nothing about it. The only thing we know is – nature has no favourite among the species."

--- From *Vanishing Species by Romaine Grey*

This section deals with information on plants and animals that are in danger. This provides substantial information on the topic which could be used as additional knowledge.

INTRODUCTION

India is one of the 12 mega diverse countries, identified by the Russian botanist Navilov, for having several unique flora and fauna. India has a total of 89,451 animal species accounting for 7.31% of the faunal species in the world and the flora accounts for 10.78% of the global total. The endemism (species found in one particular area only) of Indian biodiversity is high - about 33% of the country's recorded flora are endemic to the country and are concentrated mainly in the North-east, Western Ghats, North-west Himalayas and the Andaman and Nicobar Islands. However, this rich biodiversity of India is under severe threat owing to habitat destruction, degradation, fragmentation and over-exploitation of resources.

It is true that no animal or plant species is everlasting and that none has yet existed for more than a few million years without evolving into something different or becoming extinct. This process is usually slow in nature, but the pace of extinction of species in the recent times has been alarmingly swift.

Threatened plants and animals are those whose population in the wild is critically low and whose habitat or home range has been so drastically reduced or damaged that they are in imminent danger of extinction. The World Conservation Union (IUCN) maintains a Red Data Book providing a record of animals and plants, which are known to be in danger. It is estimated that by the time the world's primary tropical forests are lost i.e. by about the middle of the 21st century, over half the 1.7 million species of plants and animals which have been named so far, would have become extinct. India ranks second in terms of the number of threatened mammals, while India is sixth in terms of countries with the most threatened birds.

Few of the remaining green patches

Before we describe the top threatened species of our country, let us understand the terminologies that are used by the IUCN who have classified the threatened species of the world into different categories. Some of them are explained below:

1. **Extinct**
   This category is only used for species, which are no longer known to exist in the wild. Before declaring any species as extinct, scientists carry out repeated searches of the possible habitats and if there are no records for 50 years, then a species is declared as extinct. E.g. Indian Cheetah.

2. **Extinct in the Wild**
   These species are known only to survive in cultivation, in captivity or as a natural population well outside the past range. E.g. Mulberry Silk Moth.

3. **Critically Endangered**
   This includes species, which are facing an extremely high risk of extinction in the wild in the immediate future. The population of such species is very low and the threats to its habitats are very high. E.g. Asiatic Lion.

4. **Endangered**
   It includes species that are not critically endangered but are in danger of extinction if the threats to its survival continue operating. Also, species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced are deemed to be in immediate danger of extinction. E.g. Tiger.

5. **Vulnerable**
   It includes species that are not endangered but are likely to move into the endangered category in the near future if the threats to its survival continue operating. It also includes species whose populations are still abundant but are under threat from severe adverse factors throughout their range. E.g. Giant Clam.

6. **Near Threatened**
   A species is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for one of these categories in the near future. E.g. Nicobar pigeon.

7. **Rare**
   This includes species with small populations in the world that are not at present endangered or vulnerable, but are at risk. These species are usually restricted within specific geographical areas or habitats or are thinly scattered over a more extensive range. E.g. Himalayan Rafflesia.

8. **Least Concern**
   This category is applied to taxa that do not qualify (and are not close to qualifying) as threatened or near threatened. E.g. Himalayan Newt.

9. **Data Deficient**
   When there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and population status, a species is said to be data deficient. E.g. Coconut Crab.

THREATS TO WILDLIFE: A GLOBAL VIEW

Wildlife, an important natural resource, appears to have withstood the worst of man's developmental activities. Not only has the population of individual species gone down alarmingly but also their habitat has either shrunk drastically or is being systematically made unfit for their existence. This strikes at the very root of the ability of wildlife to renew and replenish itself by its own resource.

Habitat destruction and habitat loss is the main cause of extinction in India. The continuous increase in human population and escalating demand for our natural resources will add to the list of species on the road to extinction. Habitat loss leads to the formation of isolated, small, scattered populations. These small populations are increasingly vulnerable to inbreeding, which causes loss of gene pool, high infant mortality and susceptible to environmental changes, which all may lead to extinction of the species.

In addition, exploitation such as hunting, collecting, fisheries and trade are a major threat to the survival of threatened species. Poaching or illegal trade is another insidious threat that has emerged in recent years as one of the primary reasons for the decline in numbers of species, such as the tiger.

The underlying causes of biodiversity loss, however, are poverty, macroeconomic policies, international trade factors, policy failures, poor environmental law/weak enforcement, unsustainable development projects and lack of local control over resources.

EXTINCT ANIMALS: GONE FOREVER

(Courtesy IUCN Red list of Threatened Species)

1. Asiatic Cheetah

(Acinonyx jubatus ssp. venaticus)

Introduction: Cheetah has been extinct in India since 1949. In fact, it is only one of two species known to have become extinct in India in the 20th century. It is a little smaller than the panther and much lighter in build. It lives in open semi-arid grassland, savannah, scrub or isolated low hillocks amidst plains. It is less nocturnal than most members of the cat family. It is the fastest animal on land and can achieve terrific speeds of 115-120 kmph, within a distance of about 370 m, which is very useful in hunting fleet-footed prey. Its favourite prey include antelopes, deer, hares and birds. Being easy to tame, it was used for royal hunts by the royalty. Known to be so abundant that 'stables' of over a thousand animals were reputed to have been maintained by Emperor Jehangir.

Distribution: Known distribution of Cheetah is mainly in the drier parts of southwestern and central Asia to India. In the past, the species used to occur in northern and central India. Presently extinct in India; now found in USSR and in northeastern Iran as scattered survivor.

Status: The main cause of extinction of this magnificent cat was destruction of habitat due to increase in human habitation and overgrazing by domestic stock and consequently loss of the prey species. Further, its use for sport was yet another factor which is responsible for its decline. There were plans of reintroducing the animal in some of the most suitable pockets of its erstwhile distribution in India.

2. Pink Headed Duck *(Rhodonessa caryophyllacea)*

Introduction: This duck was of the size of a domestic duck. It was about 60 cm in length. Its bill was reddish pink, eyes red orange and its feet dark with a red tint. It was not only unique in having a pink head and neck, but was also the only duck to lay perfectly spherical eggs which looked like unpolished billiard balls. Its habitat was tall grassland, floodplains and small lakes and ponds. This bird was shy and secretive, and was rarely seen unless flushed by chance from ponds amongst tall grass jungles. Being a surface feeder, it used to feed on aquatic organisms, both vegetable and animal matter.

Distribution: The duck was a resident of northern and northeastern India (Orissa, Bihar, Bengal, Assam and Manipur) in the forested foothills of the Himalayas and the adjoining plains. Some were also recorded as winter visitors to Punjab, Uttaranchal, Maharashtra, Andhra Pradesh and Tamil Nadu. It was also known from Nepal and Myanmar.

Status: Probably extinct, but until the last known area of its former range is surveyed, this cannot be confirmed. The duck was probably plentiful in the 1880s. In the 1890s, about half a dozen could generally be seen in Kolkata's winter market. Although as much as Rs. 15/- was asked for each dead bird, it was more often sold alive, as its main value was as an ornamental creature. It was not regarded as a good table bird. Its population started declining as early as 1878, obviously due to the shrinkage of its habitat and hunting. The last authentic sight record was in June 1935 (Darbhanga, Bihar). From 1984-1990, under the Project Endangered Birds, BNHS carried out intensive surveys to rediscover the bird, but were unsuccessful.

3. Himalayan Quail *(Ophrysia superciliosa)*

Introduction: This quail was a dark game bird with a conspicuously red beak and red feet. It was not in fact a true quail, but perhaps closer to what might be called a pygmy pheasant. It was 30.5 cm in length with a relatively long tail and was slightly smaller than a partridge. It fed on grass seeds, berries and insects. It was seen in group of half a dozen in patches of long grass and brushwood on steep hillsides. It flew reluctantly, when practically trampled upon only settle again within a short distance.

Distribution: Known only from two places in Uttarakhand between 1,650 m and 2,100 m.

Status: The threat status of this enigmatic quail is extremely difficult due to the paucity of information. If not extinct, its population is likely to be tiny, and it probably still survives in some remote area in the lower or middle Himalayan range. It was last seen near Jerepani by Captain Hutton in June 1868. Between 1984-1990 under project Endangered Birds, BNHS carried out intensive surveys in most of the known habitats, found that the habitat was altered, and doubts were raised about the species existence.

THREATENED PLANTS

Presently, there is a great awareness on the need to conserve natural plant resources the world over. Studies undertaken during the last 3-5 decades on flora in several parts of the world have shown that many plant species are in danger of extinction while some have become extinct recently. Globally, it has been estimated that 10% of world's vascular plant species totaling to about 20,000-25,000 species are under varying degrees of threat. In India, there are about 235 vascular plant species facing some degree of danger.

1. Red Vanda *(Renanthera imschootiana)*
"Critically Endangered"

Introduction: Not a true vanda, this beautiful climbing orchid is of much ornamental value. In nature, this species grows as an epiphyte on large tree trunks at altitudes of 1000-2000 m. The flowers are very showy, large and coloured an attractive yellow-orange with red spotted petals.

Distribution: It is found in the hills of Manipur, Nagaland, Mizoram and extends into Myanmar and South-east Asia.

Status: It has been rendered critically endangered due to indiscriminate collection of plants and loss of its habitat. Some of its habitat need to be protected and the possibility of large-scale cultivation should be explored to meet the trade demands.

2. Lady's Slipper Orchid *(Paphiopedilum villosum)*
"Critically Endangered"

Introduction: A terrestrial orchid, it thrives in dense forests on cool humus rich forest floors or sometimes on moss covered rock boulders and on trees as an epiphyte. It is one of the most beautiful species among the Lady's Slipper Orchids and is much sought after in the horticultural trade for the long lasting quality of the flowers. The species has also been used for developing hybrids.

Distribution: It is found in Assam, Arunachal Pradesh, Mizoram and Myanmar.

Status: Critically endangered due to habitat loss and the large-scale collection of the species from the wild. Conversion of the forests is the main causative factor that led to the decline of the species. The species has been listed in Threatened Plant List of India and has been recommended to be included in the Wildlife Protection Act, (1972).

Please note the term "threatened" is used in the conservation context for all those species, which fall in one of the categories from extinct to rare

3. Western Flytrap *(Ceropegia fantastica)* "Critically Endangered"

Introduction: A slender twiner that grows in open semi-evergreen forests among bushes on latertic soil. The flowers are very curious, at once distinguishable by the calyx, which is longer than the flowers. The flowers adopt a unique technique for ensuring pollination, wherein they trap the pollinator within their corolla tube until pollination takes place. Hence, they get their common name.

Distribution: Endemic to Western Ghats.

Status: Critically endangered as it has been threatened by habitat loss and the absence of any conservation measures undertaken. Cultivation of plants should be initiated to stabilize the wild population.

4. Beddome's Cycas *(Cycas beddomei)* "Critically Endangered"

Introduction: A graceful palm-like plant whose stem is exposed only 10-15 cm above the ground and has dark brown peeling off scales. It grows in dry deciduous forests occurring on exposed rocky slopes and along streams. A non-flowering plant that has female and male cones growing on separate trees.

Distribution: Endemic to Cuddapah-Tirupati range of the Southern-eastern ghats in Andhra Pradesh. This species seems to have disappeared from the Cuddapah region and now it is probably confined to the Tirumala hills only.

Status: Critically endangered in the wild; the causes for its decline are habitat destruction, forest clearing and excessive collection/exploitation due to its professed medicinal properties. Local tribals prune the male cone away, which is used as major ingredient in rejuvenating tonics. The plants are often uprooted by avid plant collectors for ornamental use in private gardens. Collection and exploitation or sale should be banned and habitat restoration should be initiated.

5. Blue Vanda *(Vanda coerulea)*
"Critically Endangered"

Introduction: An epiphytic orchid with stout, robust stem, found growing in mixed pine forests on hills between 1,300-2,000 m. It is locally cultivated although; its natural populations have been much depleted in the past. The species is rated high in breeding new horticultural varieties. It has been widely used in the breeding of hybrid novelties of Vanda species, which are highly valued in horticulture trade.

Distribution: Eastern Himalayas and Northeast region of the country. It is also known from Myanmar and Thailand.

Status: The demand for its beautiful flowers is very high, hence it has been indiscriminately collected by traders and locals. However, the trade is legally banned but monitoring of all existing wild populations and protecting their natural habitats are required.

6. Dalzell's Frerea *(Frerea indica)*
"Endangered"

Introduction: A rare, endangered and endemic plant, originally found by Nicole Alexander Dalzell on a hill near Junnar where now it survives in very limited numbers. It has not been seen in other similar habitats in the adjoining hilly areas, which are being denuded and eroded. The species grows on exposed bare rocks of hill slopes and cliffs. The flowers are showy purplish, starry and succulent, having pale-yellow spots on its petals. It flowers during September-October.

Distribution: Being locally endemic, it is found in Junnar and Purandhare Hills, Pune District, Maharashtra.

Status: Besides being endemic and rare, it has also been declared as one of the world's 12 endangered species listed by the IUCN. Collection and export of this species is banned. However, the habitat of the species is incidentally free from any threats as the Purandhare Hill fort is a prohibited area for civilians. Nevertheless, exceptional care should be taken to ensure continued care and protection of the habitat and population within the fort area. Attempts to cultivate it in controlled conditions are underway and final reintroduction of this species back to its original habitats is planned.

7. Kutki *(Picrorhiza kurrooa)* **"Endangered"**

Introduction: A perennial herb with elongate, stout creeping fleshy rootstock found growing on rocky alpine slopes at 3300-5000 m altitude in the Himalayas. It is propagated by seeds and rhizomes. Widely used as medicines in a large number of ailments.

Distribution: Known to occur in the hilly tracts of Himalayas from Jammu & Kashmir to Sikkim.

Status: It has become scarce due to over-exploitation for its medicinal properties. Collection of this species from the wild should be banned. Attempts should be made to cultivate this important medicinal plant for commercial use.

8. Rosy Kalanchoe *(Kalanchoe roseus)*
"Endangered"

Introduction: A showy horticultural succulent herb with stout stem and rose-coloured flowers that grow in clusters. It grows on sandstone rocks at 1500-1800 m altitudes. Originally discovered in 1881; it was rediscovered in 1948.

Distribution: Endemic to North-eastern India from Nagaland and Manipur.

Status: The last sighting was in 1954. The thick juice from the leaves is used by the local people as an antidote for snakebites. As the wild population is very low, it needs to be cultivated in botanical gardens as a plant of horticultural and medicinal importance.

9. Indian Vanilla *(Vanilla wightiana)* **"Rare"**

Introduction: A climbing orchid that climbs on forest trees especially along riverbanks. The stems are fleshy and flowers are cream-coloured with pale green tinge. The flowering period is from February-March. As it is closely related to Tropical American Vanilla orchid of commerce, there is the possibility of it containing some useful properties.

Distribution: It is endemic to the southern most part of the Western Ghats.

Status: The main cause for its rarity is the destruction of habitat and cutting of the trees on which the plants climb. Felling of such trees should be banned and cultivation by seeds, stem cuttings and cell culture should be initiated to replenish the lost population of this rare orchid in the wild.

10. Himalayan Rafflesia *(Sapria himalayana)* **"Rare"**

Introduction: A very interesting root parasite with large showy flowers measuring up to 16 cm across. The flowers give out a foul smell to attract flies for pollination. It grows in dense, undisturbed forests in damp moist places on the roots of other plants. The whole plant is represented by its flower while other parts are much reduced or absent. The roots are attached to its host plant underground while the flower grows above the ground.

Distribution: Endemic to India and earlier it was reported from different areas of Northeast region such as Arunachal Pradesh, Manipur and Meghalaya but it is now confined to Nampdapha National Park in Arunachal Pradesh.

Status: Destruction of its habitat is the major cause for its decline. This species has been conserved in the Nampdapha forest area, as other means of conservation are difficult because of its parasitic habits and host-plant specificity.

THREATENED MAMMALS

1. Tiger *(Panthera tigris)* **"Endangered"**

Introduction: Our national animal, the tiger, is one of the most graceful and elegant animals. It lives in varied habitat like dry open jungles, humid evergreen forests and mangrove swamps. It swims well, hunts between sunset and dawn, and covers long distances in the course of a night's hunt. It is enormously powerful and all kinds of animals are its prey. It may even eat fowl, fish, reptiles and others. In the absence of natural prey, it may take to cattle lifting.

Distribution: Found practically throughout India except the deserts of Rajasthan, Gujarat,

Punjab, and higher reaches of Himalayas. However, the number of tigers is negligible in Goa, Haryana, Tripura and Manipur. Also occurs in Nepal, Bhutan, Bangladesh and Myanmar.

Status: At present, in the world, there are believed to be between 3,402 and 5,140. tigers left of which, 1,706 are present in India. It is therefore very crucial to save this very charismatic animal. Illegal poaching and loss of habitat have endangered the tiger. There has been a 95% decline in tiger numbers since the 20th century. The shrinking of habitat due to clearance of forestlands for agriculture is the main threat to the tiger. Poaching of tigers as well as its prey animals such as sambar, chital and wild boar is a more serious problem faced by the animal. Tigers have been poached for skin and body parts. Project Tiger initiated in 1973 established 9 tiger reserves in the country, which helped control the declining tiger population. Today there are 29 tiger reserves throughout India.

2. Asiatic Lion *(Panthera leo)* **"Endangered"**

Introduction: A large powerfully built cat with a light and dark coloured shaggy mane adorns the head of the male. It lives in family parties of 8-10 individuals called as a pride in scrub Savannah country, interspersed with open dry deciduous forests. It hunts by night and preys on antelope, deer, cattle and others.

Distribution: A little over 100 years ago, the Asiatic Lion ranged from western Iran to eastern India. During the 19th century, it was reported in India from Gujarat to Bihar. However, by the second half of the 20th century it had been wiped out of its entire range except Sasan Gir in Gujarat.

Status: There are just 359 individuals left alive in India. It is legally protected from hunting and trade, but the enforcement of law is inadequate. The main threats are poaching, loss of habitat to agriculture, decline in number of prey species, overgrazing by domestic stock and others. With the entire wild population of Asiatic lions confined to just one area, that population is highly vulnerable to any kind of biological, climatic or man-made catastrophe. A major disaster within the park could wipe out the entire population at a stroke. Likewise, a disease outbreak could eliminate the lion population. Therefore, an alternative home for the lions has been identified in the Kuno Palpo Sanctuary in Madhya Pradesh.

3. Asian Elephant *(Elephas maximus)* **"Endangered"**

Introduction: Elephants are forest animals requiring a shady environment but having free access to grasses, an important part of their diet and water. Elephants have a complex social system with strong maternal bonds. Mature males live singly or in small groups and may associate with the females while feeding or during mating. They spend more than two thirds of the day feeding and may consume 150-270 kg of vegetation in a day. Therefore, they need to move from one forest to another. They undertake long migrations in search of appropriate feeding grounds.

Distribution: In India, they are found in northern Uttar Pradesh, Bihar, Orissa, West Bengal, northeastern India, Karnataka, Tamil Nadu and Kerala. Also in Sri Lanka, Nepal, Bhutan, Bangladesh, east up to Vietnam, also South China and Malaysia, Indonesia.

Status: The world population of Asian Elephants ranges between 41,410-52,345 of which 26,390-30,770 are found in India. The major threat to elephant populations in India is the degradation and fragmentation of its habitat because of the human population explosion and consequent developmental needs. Poaching of elephants for ivory is still a serious problem in India. As only male Asian elephants have tusks, males are heavily poached. Being a migratory animal, the forest corridors play an important role in their survival. Such existing corridors should be strengthened. From 1980-1992, BNHS carried out ecological studies on the Asian Elephant. On the pattern of Project Tiger, an Elephant Project was started in 1992 by the Government of India with the main objective being maintaining the population of elephants.

4. Indian Wild Ass *(Equus hemionus khur)* "Endangered"

Introduction: The Indian Wild Ass is larger than the domestic ass. It is the only true Wild Ass left in the world today and hence, is of scientific interest. It is an inhabitant of salt encrusted flats (on which almost nothing grows) dotted with a few scattered islands or bets, which are the only source of vegetation. They live in herds of 3-10 and feed on grasses, crops such as wheat, cotton, and jowar, which they often raid at night. They cover long distances in search of food. They apparently drink at least every third day.

Distribution: The Wild Ass used to occur in the past from south-west Iran through Pakistan to north-western India. Now it is restricted to a small area in the Little Rann and other places in Gujarat.

Status: As per the census done in 1976, there were 720 compared to the 3,900 individuals in 2004. One of the threats is the surra disease, which is spread by domestic animals. Successive epidemics in 1958 and 1961 caused a substantial decline in its population. For the protection of this animal, the Little Rann of Kutch has been declared as a sanctuary. Vaccination of domestic stock will help in controlling the spread of the disease. Reclamation and cultivation of marshland should be stopped.

5. Lion-tailed Macaque *(Macaca silenus)*
"Endangered"

Introduction: The lion-tailed macaque is baboon-like in appearance. The colour of the body and the face is black. The tail is short with a tuft of hair at the tip like that of a lion, hence the common name. It is a gregarious animal, native to dense evergreen or semi-evergreen rain forests, seen on high trees in secluded and unfrequented areas between 800 and 1,300 m. With its dark colouring and shy and elusive habits, it is seldom seen. It lives in groups of 4-30 individuals. It feeds on fruits, buds, seeds, flowers, leaves and insects.

Distribution: Endemic to India and is known to occur in the Western Ghats from North Kanara southwards to Kerala and Kanyakumari District, Tamil Nadu.

Status: Today, less than 2500 mature individuals are surviving. The shrinkage of habitat has brought about a considerable decrease in the population of this macaque. Diversion of forests for large irrigation, power and mining projects and extension of roads are not only responsible for the loss of habitat but have even opened up inaccessible areas to human beings. Modified land use for agriculture, extension of coffee and tea plantations and replacement of endemic forest trees by exotic species like eucalyptus and wattle are the major factors for the reduction in its numbers. Some locals are also killing it for fur trade and the supposed aphrodisiac and medicinal properties of its flesh.

6. Dugong or Sea Cow *(Dugong dugon)* **"Vulnerable"**

Introduction: It is a marine mammal related to dolphins. It has a streamlined body with massive head. The animal is clumsy and sluggish in its habits. It is restricted to coastal, shallow, marine habitat with ample food plants. It feeds mostly on marine grass and algae in the night hours. They are usually seen in small groups or alone. The habit that females have of standing up with their young ones clasped while, partly above water has given rise to the stories of mermaids.

Distribution: In India, it has been reported from the Gulf of Kutch, Konkan coast and the Malabar coast and from Tuticorn, Dhaneshkodi Island, Rameshwaram Island, Krusadai Island and Pambam Island on the East Coast, and also from the Andaman & Nicobar Islands. It is also found in other tropical coasts of the world.

Status: The dugong has been hunted for its flesh, hide, fat, bones and tusks. The flesh is relished throughout its range. The hide has been used to make good quality leather and the fat is used as cooking oil. Bone powder is used for making native medicines while tusks are used

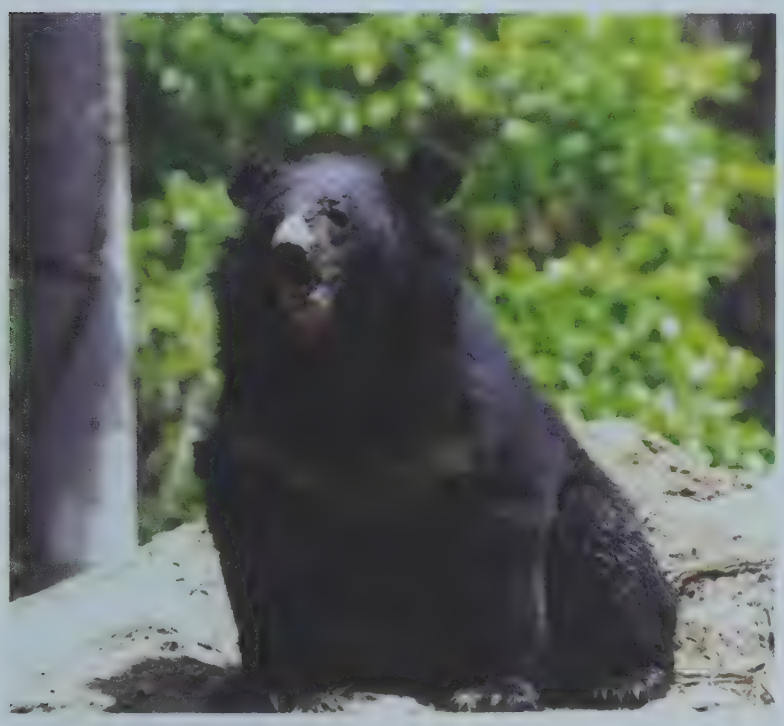
to make ivory artifacts. Hunting pressure appears to be the main, if not the only cause of the depletion of the dugong population. It has become scarce practically throughout its range of distribution. Creation of protected areas especially for the conservation of these species will help the declining population.

7. Red Panda *(Ailurus fulgens)* **"Vulnerable"**

Introduction: The Red Panda is a handsome, tree dwelling animal. It is actually a cat-bear and not a bear. It inhabits temperate forests at elevations from 1,500 m to 3,500 m. It is a nocturnal animal and prefers to sleep during the day in tree holes or on open branches. Though bamboo sprouts, grass roots, fruits and acorns comprise its principle diet, it also feeds on eggs, birds, mice, insects and their grubs.

Distribution: Central and eastern Himalayas from Nepal to Arunachal Pradesh. Also, found in north Myanmar and south China.

Status: It is rated as vulnerable as it continues to decline. The major threats to red pandas are loss and fragmentation of habitat due to deforestation (and resulting loss of bamboo) for timber, fuel and agricultural land. Moreover, it is being trapped and hunted for its beautiful pelt. Locals in China use the fur of red pandas to make hats and clothing.



8. Himalayan Black Bear *(Ursus thibetanus)*
"Vulnerable"

Introduction: The Himalayan black bear is most populous in the mountainous country and jungle. It is nocturnal or crepuscular and lives in dens in rock crevices, in hollow trees or stumps, under upturned trees, in dug-out earthen dens, or in ground nests. In the summer, they live largely on wild fruit and berries and raid orchards for pears, apricots and nuts. Honey is greatly sought and insects, termites and beetle larvae provide variety to their diet.

Distribution: In Indian limits, it is known to occur at the foothills of the Himalayas. This species occupies a narrow band from south-eastern Iran eastward through Afghanistan and Pakistan to Myanmar and including China, Taiwan and the southern islands of Japan. It occupies all countries in mainland South-east Asia except Malaysia.

Status: This bear is categorized as vulnerable because widespread illegal killing of bears and trade in body parts. These bears are hunted for their skins, paws and especially gall bladders. Another major cause for it's decline is habitat loss due to logging, expansion of human settlements, roadway networks, and hydro-power stations.

9. Blackbuck or Indian Antelope
(Antelope cervicapra) **"Vulnerable"**

Introduction: The blackbuck is a handsome antelope. A dweller of the Indian plains, it prefers flat open ground covered with grass, scrub, bushes and others. but avoids forests and hilly tracts. After Cheetah, it is said to be the fastest animal which can reach a speed of 100-104 kmph and when alarmed moves off in series of leaps and bounds. It feeds on grass, weak-stemmed plants, shrubs, pods of Acacia, fruits and others. Seen in herds of 10-30 or even over 100 individuals. Each herd has a master buck (male), which may live in the company of as many as 50 does (females) or more.

Distribution: Occurs throughout the Indian plains, the eastern limit being Chilka Lake in Orissa and southwards extends to Point Calimere in Tamil Nadu. It is quite abundant in Rajasthan and Gujarat. Outside India, it is known from Pakistan and Nepal.

Status: It is rated as vulnerable as it was once plentiful all over its range of occurrence, but has disappeared from many places where it was quite common a few decades ago. It has been hunted for its prized meat and as a sporting trophy. The number of blackbuck has fallen from an estimated population of 80,000 in 1947 to about 8,000 in 1964. However, the population has recovered in recent years. Cattle grazing and human interference in and around its habitat must be stopped.

10. Yak *(Bos mutus)* **"Vulnerable"**

Introduction: It is a massively built ox, with short sturdy limbs and drooping head and humped shoulders. It lives in the coldest, desolate and rugged mountain terrain, near the snowline. It moves in small herds and feeds on grass and shrubs. It also takes frozen snow and salt encrusted earth. Yak herds travel on snow in a single file carefully stepping on imprints left by the leader. It breeds freely with domestic cattle.

Distribution: Known from Changchen-mo valley in Ladakh. Sometimes it strays into valleys of Uttaranchal, through Tibet to northern Nepal and Sikkim. Also, found in China.

Status: Yaks are important for the gene pool from which domesticated stocks have been derived. Domesticated yak is an indispensable beast of burden in the alpine and sub alpine mountain terrain and is traditionally used for many purposes. Its meat and hide are widely used articles. Wool and tail-tuft are much sought after articles for trade. Besides this disturbance in its habitat, competition from domestic stock and contagious diseases are some of the major threats.

THREATENED BIRDS

1. Siberian Crane *(Grus leucogeranus)*
"Critically Endangered"

Introduction: A large bird of the size of the common crane, standing 140 cm tall. It is a migratory bird from Siberia, which used to visit India during late November and early December and leaving by the end of March to beginning of April. Since 2002, Siberian cranes have not been sighted in India. It is essentially a bird of the wetland and never moves away from marshy areas. This crane moves about in family parties of three or four, or in small flocks of a dozen or so. It feeds exclusively on various parts of aquatic vegetation.

Distribution: This migratory bird was formerly a widespread winter visitor to northern India in Keoladeo National Park (Bharatpur) in Rajasthan and Payagpur jheel in Uttar Pradesh .

Status: Critically endangered because it is expected to undergo an extremely rapid decline in the near future, primarily because of the destruction and degradation of wetlands in its passage and wintering ground. The wintering site, holding 95% of the population, is threatened by hydrological changes caused by the Three Gorges Dam. The key threat is wetland loss and degradation at the breeding areas and wintering sites due to agricultural development, the development of oilfields and increased human utilization. The global population is around 3,200.

2. White-Backed Vulture
(Gyps bengalensis)
"Critically Endangered"

Introduction: It was one of the more common vultures. It is a carrion-feeder and useful scavenger in the countryside and in the environs of towns and villages. Earlier, when the vulture population was huge, large gatherings used to collect at animal carcasses with astonishing promptness and demolish them with incredible speed. Now such sights have become rare due to a plummeting decline in its population.

Distribution: Occurs from south-east Iran, south-east Afghanistan, east Pakistan, India, Nepal, Bhutan, Bangladesh and Myanmar. In India, it is found from Himalayas west to Srinagar, east to

Arunchal Pradesh, Assam and the north-east hill states, south to the southern Western Ghats in Kerala and Tamil Nadu.

Status: Critically endangered because it has suffered an extremely rapid population decline, particularly across the Indian subcontinent, as a result of feeding on carcasses of animals treated with the veterinary drug Diclofenac. BNHS is striving to revive the lost population at its breeding centre in Pinjore, Harayana and Buxa and West Bengal. Due to BNHS initiatives, the drug is now banned and replaced by Meloxicam.

3. Great Indian Bustard *(Ardeotis nigriceps)* "Endangered"

Introduction: A large ground bird, with a long neck and long bare legs, looking somewhat like a small ostrich. It is the state bird of Rajasthan. It is an inhabitant of open country having thorny bushes and tall grass interspersed with cultivation. The bird moves about singly, in pairs or in small to large parties of three, four to two dozen, or more. A very shy and wary bird, when alarmed it prefers to run to hide behind a bush than fly. Omnivorous in its diet, which includes insects, other arthropods, lizards, snakes, fruits, grains and tender shoots.

Distribution: About a century ago, the bird was widely distributed from the Central Punjab to Central Tamil Nadu and Western Orissa to Eastern Pakistan. At present, the bustard is seen in the arid and semi-arid areas of Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh, and Maharashtra.

Status: Endangered because of its very small, declining population, as a result of hunting and continuing agricultural development. In 1980-1987, BNHS had carried out research in three areas: Maharashtra, Andhra Pradesh and Madhya Pradesh. The study resulted in the establishment of national parks and wildlife sanctuaries for the protection of the bird. The present population could be as low as 500, which is one fourth of the population ten years ago.

4. Lesser Florican *(Sypheotides indicus)* "Endangered"

Introduction: A grassland bird found all over India that inhabits tall grass patches, scattered bushes and cultivated tracts. It frequents standing crops, especially those of cotton and millet. It feeds on insects, centipedes, lizards, frogs and on vegetable matter like shoots, grasses, herbs and fruits. The male makes a harsh, frog-like croak during the courtship display.

Distribution: Virtually endemic to India, although there are persistent records from Nepal, Pakistan and one unconfirmed record from Myanmar. It occurs from Gujarat and Central Rajasthan, east to West Bengal and Orissa and from north-west Uttar Pradesh to south Kerala.

Status: Endangered because it has a very small, declining population, primarily a result of loss and degradation of its dry grassland habitat, hunting and failure of monsoon rains. The rate of decline is predicted to increase in the near future as pressure on the remaining grassland intensifies. Between 1984-1990, BNHS carried out a research project to study the status and distribution of the bird. The present population is of 3,530 birds.

5. Sclater's Monal Pheasant
(Lophophorus sclateri) **"Vulnerable"**

Introduction: An iridescently coloured bird that inhabits deodar, pine, oak, rhododendron and birch forests in the Himalayas between 2,600 and 5,000 m elevation.It generally frequents open glades, pastures, hillside scrubs and grassy slopes. Found singly, in pairs or in small parties. Feeds on roots, tubers, bulbs and other vegetable matter and on larvae of insects and worms. It generally frequents open glades, pastures, hillside scrubs and grassy slopes. Found singly, in pairs or in small parties. Feeds on roots, tubers, bulbs and other vegetable matter and on larvae of insects and worms.

Distribution: The pheasant occupies a restricted area of Eastern Himalayas in India, Myanmar and south-east Tibet to west Yunnan in China.

Status: This striking pheasant is poorly known across all of its remote, inaccessible and relatively restricted range. It is vulnerable because it probably has a small population, which is naturally fragmented and subject to significant decline. Habitat degradation and over-exploitation for food are presumably the major threats. In addition, the glossy metallic purple, blue and bronze plumage of the bird was used to decorate headdresses for royalty. Areas like Nampdapha in Arunachal Pradesh have been declared as a national park for protection of this bird.

6. Black-necked Crane *(Grus nigricollis)* **"Vulnerable"**

Introduction: This crane is a revered symbol of prosperity for the local people in the Ladakh Valley where it breeds. It breeds on the shores of the high altitude lake area and swampy bogs between 4,300 and 4,600 m, but inhabits reed beds and open fallow paddy fields during its winter quarters.It feeds on fallen grains and probably also on roots tubers, insects and small vertebrates. It has an elaborate courtship display in which both the sexes take part.

Distribution: It breeds mainly in central Asia from Qinghai-Tibetan plateau, south to Central China and only a small population breeds in Ladakh and Bhutan. Very small numbers have wintered in Arunachal Pradesh.

Status: Vulnerable, as it has a small, declining population due to loss and degradation of wetlands, changing agricultural practices and increased human activity in its breeding and wintering ground. It is legally protected and its hunting is prohibited.

7. Pallas's Fish Eagle *(Haliaeetus leucoryphus)*
"Vulnerable"

Introduction: A large fish eating eagle found around large rivers and *jheels*. It captures fish by hurling itself on the quarry from the air and seizing it in its talons. Besides fish, it feeds on snakes, rats, crabs, water birds and even carrion.

Distribution: Widespread from Kazakhstan, Russia, Uzbekistan, Tajikistan, Mongolia and China, India, Pakistan, Bhutan, Bangladesh and Myanmar. In India, it is a widespread breeding species on lakes and large rivers in the north and north-east of the country.

Status: Vulnerable as it is inferred to have a small, declining population in wetlands and breeding sites throughout its range. The population is likely to be 10,000 in the world and in India it is very rare and probably close to extinction with only a few individuals, as low as 50. The key threats are habitat loss, degradation and disturbance. Most of its wetlands have been drained or converted for agriculture and human settlements. In addition, pesticides, industrial effluents in the wetlands have reduced its breeding success.

8. Western Tragopan *(Tragopan melanocephalus)*
"Vulnerable"

Introduction: A large colourful bird, which generally inhabits thick undergrowth in bamboo, in hill forests between 1,350 and 3,600 m altitude. It moves about singly or in pairs, also in small family parties outside the breeding season. Its food consists of vegetable matter and insects. Roosts on the branches of trees during the night.

Distribution: Originally, found in the Western Himalayas from north Pakistan through Kashmir and Himachal Pradesh to Garhwal and possibly Kumaon in Uttaranchal.

Status: Vulnerable because it is sparsely distributed, with a small declining population and continuous forest loss and degradation throughout its restricted range. Loss of habitat and commercial exploitation for trade are the major threats. It is the rarest among Himalayan pheasants having a population of 1,600-4,800 birds. Hunting of the bird as well as possession of skins, plumage and trade in live birds is prohibited in Pakistan and India.

9. Nicobar Pigeon *(Caloenas nicobarica)*
"Near Threatened"

Introduction: A ground pigeon that is an inhabitant of the heavy evergreen forest and freely moves about the forest floor, walking with wings drooping at the sides and pushing aside fallen leaves with the beak. The flight is swift and powerful. It is rather silent but occasionally utters a harsh guttural croak. The food consists of fruits and seeds fallen on the forest floor.

Distribution: Found in the Nicobar group of Islands, south Andaman Island and Cocos Island and in islands of Indo-Australasian region.

Status: Nearly threatened from the relentless trapping for food, the pet trade and their gizzard stones. Also, clearing of islands for plantation and infestation of rats, cats and other alien predators also act negatively on their population. Encroachment on the habitat of the pigeon, hunting for its flesh and as a trophy have practically wiped it out from the Andamans, while on the Nicobar Islands too its position is precarious at least in the Indian part of its distributional range.

10. Malabar Pied Hornbill
(Anthracoceros coronatus) **"Near Threatened"**

Introduction: The Malabar Pied Hornbill can be found in open woodland and cultivation, often close to habitation. It is a large hornbill, at 65 cm in length. This species is omnivorous, taking fruit, fish and small mammals.

Distribution: It is restricted to central and southern India, confined to land under 300 m, and Sri Lanka, restricted to more secluded forest of the dry lowlands.

Status: Forest on Sri Lanka has suffered rapid degradation and fragmentation in the past decades through excessive gathering of fuelwood, clearance for permanent agriculture, shifting cultivation, fire, urbanisation and logging. Closed-canopy forest is estimated to have declined from 29,000 km^2 (44% of the island's area) in 1956 to 12,260 km^2 in 1983 and similar losses are occurring in mainland India. It is reportedly collected for medicinal purposes in Orissa.

THREATENED REPTILES AND AMPHIBIANS

1. Gharial *(Gavialis gangeticus)*
"Critically Endangered"

Introduction: A large, slender-snouted, fish-eating amphibious crocodile. The adult male bears a tough bulbous projection at the tip of the snout, resembling an earthen pitcher or '*ghara*', hence the name. It is perfectly adapted to lead an aquatic life. An expert swimmer and an excellent diver too. It prefers large rivers with extensive sand and gravel banks and islets for basking in the sun. It feeds mainly on fishes.

Distribution: Largely restricted to the Himalayan fed Ganga and Brahmaputra rivers and their tributaries and further south in Mahanadi River in Orissa. It is also known to occur in the rivers of Nepal, Bangladesh and Pakistan.

Status: In the 19th and early 20th centuries, the gharial was in abundance in many areas, but it is now extinct or extremely depleted throughout its former range. The estimated Indian population was about 75 individuals in 1970 and the species was almost on the verge of extinction. However, due to the conservation measures adopted by the Indian government to breed and release the crocodiles, the population of the species rose to 4,000 in 1980. The major factors that had contributed to the extreme depletion of its population are extensive hunting and trapping for commercial utilization of its skin, which is of great demand in the international market and for its flesh for medicinal use. In addition, rapid urbanization and construction of dams have affected the waterways. Its eggs and hatchlings are heavily predated by other animals as well as collected by tribals.

2. Green Sea Turtle *(Chelonia mydas)*
"Endangered"

Introduction: It is the largest of the hard-shelled species of marine turtles and is considered to be commercially the most valuable reptile in the world. It is unique among all marine turtles in being mainly herbivorous, highly migratory, with well-developed homing abilities. It frequents inshore waters less than 25 m. in depth, sheltered by reefs. It feeds on submerged marine algae and seaweeds. Favourable sandy beaches are selected for nesting.

Distribution: Found in all the tropical and subtropical oceans of the world. It is generally distributed throughout Indian and Indo-Chinese waters.

Status: Owing to the commercial exploitation of its skin and flesh, the turtle has become extremely endangered and its population has alarmingly dwindled throughout the world. In India, the population has declined drastically during the last few decades because of direct and indirect human interventions.

3. Marsh Crocodile or Mugger
(Crocodylus palustris) **"Vulnerable"**

Introduction: The mugger is smaller than the estuarine crocodile, which is the largest among all crocodiles. It is sluggish in nature and is mainly found in freshwater habitat. It prefers still waters having 3-5 m. depth and may be present in rivers, streams, jungle pools, man-made lakes, village ponds and large irrigation reservoirs. It is a carnivorous feeding on fishes, frogs, birds and small mammals.

Distribution: Range of distribution includes Iran, Pakistan, India, Bangladesh, Nepal and Sri Lanka. In India, it is found in scattered population all over the country, except in the states of Jammu and Kashmir, Himachal Pradesh, Punjab and the northwestern desert region. Its eastern most limit of distribution is Arunachal Pradesh.

Status: In India, there are multiple threats that have rendered the reptile vulnerable. The most important threat is hunting for its hide and medicinal value of its body parts. The population has also been affected by the predation of its hatchlings by birds like herons and storks. Finally, natural calamities like floods, desiccation and habitat destruction have also taken their toll. However, the population of this crocodile had been depleted considerably throughout its range; the captive breeding programmes primarily undertaken by the Government of India and the Madras Crocodile Bank helped the species survive. Presently captive breeding programmes for this species has been stopped. The present population size in India is estimated to be between 3,000 to 5,000.

4. Reticulated Python *(Python reticulatus)* "Near Threatened"

Introduction: It is the longest and heaviest of all the Indian snakes. It attains a length of about 10.1 m. It inhabits wet evergreen forest and is semi aquatic. Its food consists of small mammals, birds and reptiles; occasionally medium-sized mammals like wild boar, deer, cattle and even man become its prey.

Distribution: Occurs in Nicobar Islands. Also, found in Myanmar to southeastern Asia.

Status: A most coveted species among the Indian serpents, being mainly hunted for its highly prized skin. Strict implementation of laws should be done to curb poaching and captive breeding should be initiated for increasing the wild population.

5. Yellow Monitor Lizard *(Varanus flavescens)*
"Least Concern"

Introduction: A large lizard which is a very good swimmer and prefers to make burrows on muddy bunds around ponds, lakes and canals. Rodents, freshwater crabs and small fish are its main food items.

Distribution: Known from northern India from Punjab to Orissa, West Bengal and Assam. Also from Bangladesh, Nepal and Pakistan.

Status: The population of the lizard had alarmingly dwindled throughout the Indian subcontinent primarily due to illegal and extensive exploitation of the adults for their commercially valuable skins, and utilization by man for food. In addition, collection as specimens for colleges and scientific institutions and habitat loss through agricultural uses has also affected the population.

6. Himalayan Newt *(Tylototriton verrucosus)*
"Least Concern"

Introduction: The only species of salamander known from India. It has a long tubercular body, depressed head, two pairs of limbs and a vertically flattened tail, which is longer than the body. It is quite rare and is found in both seasonal and perennial pools in certain hilly pockets of eastern Himalayas. Various localities have been recorded in Darjeeling district of West Bengal, on altitudes between 1,260 and 2,220. Adults congregate in pools after one or two pre-monsoon showers during April-May for breeding. Hibernation takes place in late October. Its food consists mainly of aquatic vegetation, insect-larvae, tadpoles and earthworms.

Distribution: In India, it has so far been recorded from West Bengal, Sikkim, Arunachal Pradesh and Manipur. It also occurs in Nepal, Myanmar, Thailand and western China.

Status: On account of urbanization and water pollution, this species may become rare throughout its range and needs protection.

OTHER THREATENED ANIMALS

1. Kaiser-I-Hind Butterfly *(Teinopalpus imperialis)*
"Near Threatened"

Introduction: A beautiful swallowtail butterfly which measures 9.2 cm. It is rare and is known to occur at medium and higher elevations in mountainous wooded areas. It usually remains in the tops of trees, from which it only comes down in the morning when the sun is shining. Its flight is very fast and surprisingly, it never visits flowers for nectar but feeds on animal dung, sweat and urine.

Distribution: Known to occur in Darjeeling, Sikkim, Assam, Bhutan, Meghalaya, Manipur and Myanmar.

Status: The butterfly is local and is never reported to be abundant, although it is fairly widespread. The major threats are habitat loss by deforestation of Himalayan forests and butterfly collection for foreign trade.

2. Relict Himalayan Dragonfly
(Epiophlebia laidlawi)
"Near Threatened"

Introduction: This is a unique insect having both dragonfly and damselfly characteristics. The adult wings are stalked like those of the damselfly, but the body features are more like those of the dragonfly. It is also considered a living fossil as it has not changed since the Dinosaurs' era. They are found at altitudes between 2,000 and 2,700 m.

Distribution: In India, it is found only in the Eastern Himalaya mountains, between Darjeeling and the Kathmandu valley in Nepal.

Status: This unique insect is under threat as it has a very specific habitat and alteration of habitats and pollution of hill streams are threatening its existence.

3. Giant Clam *(Tridacna maxima)* **"Vulnerable"**

Introduction: Among the sea clams, the giant clams are the largest and heaviest of living bivalves. The heavy shell is coarsely fluted and toothed with interiors thickly enameled and polished.

The giant clam may weigh over 225 kg and attain a length of over 1.2 m. Its foot is short but it attaches itself with strong byssus threads to coral or rocks. It has only one adductor muscle connecting the two valves but its pulling power is so great that anything caught between the valves can rarely be pulled out.

Distribution: Found in the South Pacific and Indian Ocean, especially in the Great Barrier Reef. In Indian seas, giant clams occur chiefly attached to coral reefs in the Gulf of Mannar and in larger numbers around the Andaman and Nicobar Islands and Lakshadweep Islands.

Status: Exploitation for trade is the most threatening factor to the clam's existence. Local people from South-east Asia have used all species of clams extensively. Clam meat is of great demand in Hong Kong, Singapore, Japan and Taiwan. The shells are used for a variety of decorative and practical purposes. Small clam shells are used as bowls, ash trays and soap dishes. In order to reduce the exploitation for food, giant clams' culture studies are under progress. The BNHS has spear-headed an International Marine Protected Area project to conserve the giant clams off the Agatti coast of Lakshadweep.

4. Coconut Crab *(Birgus latro)* **"Data Deficient"**

Introduction: The Coconut crab is probably the largest terrestrial arthropod in the world. It has two huge pinching claws and is known to climb up coconut trees and with their stout pincers bore holes in the coconuts, extract the kernel and feed on it, hence the common name. On coral islands, it is an important scavenger and its burrowing activity is probably helpful in moving surface organic matter underground.

Distribution: Found throughout many of the islands of the Western Pacific and Eastern Indian oceans. In India it occurs on the the Andaman and Nicobar Islands.

Status: In India, the decline appears to be mainly due to over-exploitation and disturbance from expanding human settlements. Being labelled as rare, protection should be afforded to this species in vulnerable areas. Due to intensive hunting by coral island inhabitants who consider it a delicacy and an aphrodisiac, the crab may have been exterminated from its known range of distribution. It has been intensively hunted by the local inhabitants in many places, and is reported to be extinct on a number of islands. Apart from being collected for food, coconut crabs are taken for sale as curios. Dried and mounted specimens are popular as tourist's souvenirs. Breeding populations on small islands are eliminated by intensive collection. Besides, pigs, rats, monitor lizards and monkeys have been implicated in coconut crab predation.

5. Horseshoe Crab *(Tachypleus gigas)*
"Data Deficient"

Introduction: These crabs are actually marine arachnids, which are also known as living fossils. They are marine bottom dwellers living in sandy and muddy bays and estuaries. They are heavily armoured and may reach a length of 60 cm. The crabs have been described as 'walking museums' since their carapaces provide a suitable habitat for large numbers of marine creatures. There is a long mobile tail spine, which aids forward movements.

Distribution: Found on the Indian coast, Thailand, Malaysia, Singapore, Indonesia, the Philippines and Borneo.

Status: Although still abundant in some areas, horseshoe crabs are exploited intensively by man for animal fodder. They are usually harvested from breeding beaches. They are also used for extraction of *Limulus lysate* for biomedical purposes.

REDISCOVERIES: LOST AND FOUND

1. Forest Owlet *(Heteroglaux blewitti)*
"Critically Endangered"

Introduction: The forest spotted owlet is very similar to the common spotted owlet, but is slightly larger and has shorter wings and tail. It is a bird of the deciduous forests. Practically nothing was known about its habits except that it was fairly diurnal and shy.

Distribution: The bird was known to be endemic to Central India but after its rediscovery in 1997 it has been recorded from four other places in northern Maharashtra and South-western Madhya Pradesh.

Status: The bird is critically endangered as it was assumed to be extinct. The last specimen collection was done in October 1914. Various attempts thereafter, by competent ornithologists to locate this bird in Orissa and elsewhere had failed. But, a startling discovery of this rare bird in 1997, after being missing for 113 years, in Maharashtra forests has saved this bird from being added to extinct animals' list. As per the recent study carried out by BNHS around a 100 birds have been found in the wild so far. The present threats are tree cutting due to which there is scarcity of trees with suitable nest holes. In addition, tribals use various owl parts for magic and therefore hunt the owlet.

2. Jerdon's Courser *(Rhinoptilus bitorquatus)* "Critically Endangered"

Introduction: The courser is a lapwing-like nocturnal bird. It occurs in sparsely forested areas, scrubs and deciduous bush jungles spread over the rocky ground in river valleys. It is found either in small groups or in pairs throughout the year. It runs for safety into thick cover or takes flight when alarmed.

Distribution: Endemic to southern India where it is known from Godavari and Penner valleys of Andhra Pradesh.

Status: Since its discovery in 1848, it was rarely recorded. Last authentic sight record was in the year 1900, since then several thorough searches by competent ornithologists have failed to rediscover it. It was believed to be extinct but between 1984-1990, BNHS carried out a project to study the exact status of the bird and on 14 January 1986, the bird was rediscovered in Cuddaph district in Andhra Pradesh by BNHS scientist, Bharat Bhushan. It is critically endangered as it has a small and declining population, which is thought to be threatened by the exploitation of scrub-forest, livestock grazing, disturbance and quarrying.

3. Lost Lady's Slipper Orchid
(Paphiopedilum fairrieanum) "Endangered"

Introduction: A very elegant orchid much valued in horticulture as the flowers have lasting quality. It is reported to grow on crystalline limestone in sheltered grassy slopes, on moss-covered boulders in oak forest floors and near streams and rivers in the altitudes of 1,400-2,200 m. The corolla is shaped like a lady's slipper and also, it was rediscovered after 50 years since 1857, hence its common name.

Distribution: Endemic to the Eastern Himalayas and is restricted to some pockets in Sikkim, Bhutan and Arunachal Pradesh.

Status: Endangered due to over-collection of specimens. Forest fires and grazing have also led to the decline of the species in its natural habitat. It is included in Appendix II of CITES which restricts its export. Protection of its natural population, habitat and cultivation for reintroduction of plants into original habitats could be adopted for its survival.

Trade in Wildlife

Courtesy TRAFFIC-India/WWF-India

This section deals with facts and figures related to trade in plants and animals in India.

Wildlife Trade items

Trade in wildlife and its derivatives, worth more than US$ 20 billion annually, is a global phenomenon with serious ramifications for the conservation of biodiversity in all its beauty and variety. India, being a source country and an avenue for transiting goods, has always been an important centre on the world trade map.

Uncontrolled hunting of wildlife for pleasure, food, furs, skins, horns, tusks and others. pose a serious threat to the survival of wildlife. Remember the Indian Cheetah was hunted to extinction! The illegal trade in animal skins has been responsible for the destruction of a large number of tigers, leopards, deer, lesser cats and snakes, as well as birds with beautiful plumage. Elephants were hunted for ivory and rhinos for their horns; wild orchids and medicinal plants, butterflies and corals; all form part of the trade, making India a focal point in more ways than one. In order to deal with this challenge, the Government of India has banned the hunting of wild animals and trade in their parts. Despite this, commercial activity continues in a covert and illegal manner. Added to this, is the pet trade in exotic mammals, birds and reptiles and the use of wild animals in biomedical research.

FACTS ABOUT WILDLIFE TRADE: A GLOBAL VIEW

- Global trade in wildlife is estimated to be over US$ 20 billion annually, of which 30% is illegal.
- Global trade includes at least 40,000 primates, ivory from at least 90,000 African elephants, 1 million orchids, 4 million live birds, 10 million reptile skins, 15 million furs and over 350 million tropical fish.
- The United States is the largest consumer of wildlife in the world.
- Between 1985 and 1991, a total number of 40,66,112 specimens of Monitor Lizards consisting exclusively of skins, were exported from Africa.
- Musk from Musk Deer can fetch up to four times the price of gold, Asian Rhino horn in Taiwan, Clouded Leopard coats in Japan and rare butterflies can fetch high price.
- In India, export of all wild animals and derivatives (except shed peacock feathers) is prohibited.
- Among illegal businesses, illegal wildlife trade is reportedly next in value to narcotics and the illegal arms trade.

List of Countries involved in Wildlife Trade					
MAJOR EXPORTERS				MAJOR IMPORTERS	
1.	Argentina	15.	Nepal	1.	Canada
2.	Australia	16.	Paraguay	2.	China
3.	Bolivia	17.	Peru	3.	European Union
4.	Brazil	18.	Philippines	4.	Hong Kong
5.	Central African Republic	19.	Senegal	5.	Japan
6.	China	20.	South Korea	6.	North and South Korea
7.	Columbia	21.	Sudan	7.	Singapore
8.	Congo	22.	Taiwan	8.	Taiwan
9.	Guyana	23.	Tanzania	9.	United Kingdom
10.	Honduras	24.	Thailand	10.	United States
11.	India	25.	Turkey	11.	United Arab Emirates
12.	Indonesia	26.	United States	12.	Yemen
13.	Mexico	27.	Former USSR		
14.	Myanmar	28.	Zaire		

FURS AND SKINS

- The wild fur trade in India deals with at least 20 species of animals. Of these, 18 species are endangered or vulnerable. They are Tiger, Snow Leopard, Common Leopard, Clouded Leopard, Lynx, Fishing Cat, Leopard Cat, Desert Cat, Rusty Spotted Cat, Palm Civet, Grey wolf, Indian fox, red fox, jungle Cat, small-Clawed Otter, Smooth Coated Otter and Jackal.
- Earlier there was a flourishing illegal fur trade between India and Nepal. Now the fur items are not openly displayed in the Kathmandu markets, which was once flooded with such items. Nevertheless, the trade exists covertly.
- The furs and skins are used in the making of products like belts, coats, jackets, hats, gloves, short and long coats. Fur is also used in small items like wallets, belts, walking sticks and as trimmings in fashion garments.

Animal Fur

There is a sufficiency in the world for man's need but not for man's greed.

by Mohandas K. Gandhi

LIVE MAMMALS

- Globally, as many as 80-90% of the primates used in medical research come from the wild.
- USA, the largest primate market in the world imports 13,000-17,000 live animals per year.
- Nearly 50,000 live Indian Pythons were imported by USA between 1977 and 1983. The pythons can fetch high price in USA, Europe and Japan.
- Although all legal trade in live animals and reptiles is banned in India, illegal smuggling continues particularly through the land borders with Pakistan, Bangladesh, Myanmar and Nepal and through sea routes.

Performing Sloth Bear

- In 1992, 200 Indian star tortoises were seized in the Netherlands bound for USA.
- Bear cubs collected in India are regularly smuggled to Southeast Asian countries via Nepal, and to Pakistan for bear-baiting. Other mammals traded are Slow Loris, Red Panda, Hoolock Gibbon, Clouded Leopard, Leopard Cat for pet and large cats for circus.
- In 1993, three Clouded Leopards and one leopard were seized from an Indian national at Kathmandu in transit. Mir Shikar toli in Patna (Bihar) is one of the largest live animal market in India.
- World over, live animals are used in zoos, circuses, private collections or breeding programmes.
- Between March 1997 and May 1997, 7000 live turtles and tortoises were seized in India.
- Thousands of Spiny-tailed Lizards were collected in western India and used for extracting oil, which is supposed to have aphrodisiacal properties.

LIVE BIRDS

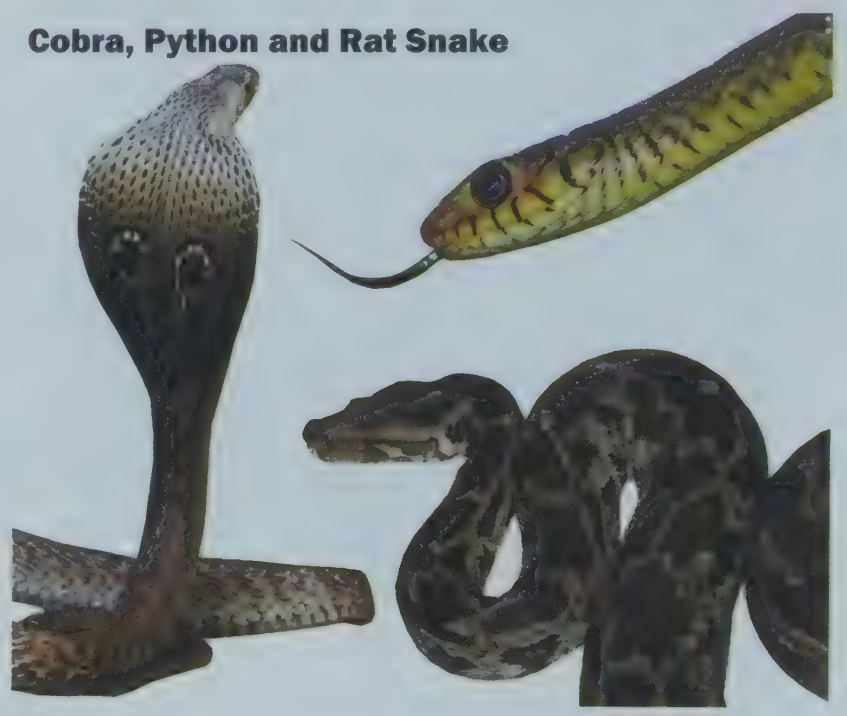
- The earliest record of trade in Indian birds is of 400 B.C, when a Greek physician took a bird from India to teach it Greek.
- The minimum declared value of the world bird trade is US$ 44 million.
- About 3.5 to 5 million wild birds are documented in international commercial trade annually. Given mortality estimates, at least 14 to 20 million birds are captured from the wild annually.
- On a global basis, one out of three birds caught from the wild survives on an average; one dies during capture and another during transportation.
- As many as 5,00,000 live Parrots and Parakeets enter the global trade annually.
- Peregrine Falcons that are used in falconry for hunting smaller birds in Dubai.

Raptor for Sale

- In 1990-91, following the ban on trade in wild caught birds, more than 50,000 birds have been seized from northern India (mainly Delhi).
- Between 1994-1995, about 1.2 million birds of Indian origin were reportedly smuggled from Kathmandu to European countries.
- Around 250 native species of our country are trapped and traded for seven different purposes: pet, food, release, falconry, zoo, black magic, medicine and taxidermy.
- As per the Wildlife Protection Act, 1972, keeping and sale of wild birds is prohibited.

REPTILE SKINS

- It is estimated that India used to export US$ 60 million worth of reptile skins annually when the trade was legal. Today there is no overt trade but illegal trade continues.
- In 1977, when the trade was legal in India, approximately 4 million Cobra and Rat Snake skins and approximately 10,000 Python skins were exported.
- The worldwide trade in monitor lizard is today approximately one million skins per year. In 1977, India officially exported approximately 1 million Lizard skins.
- 1.5 to 2 million crocodile skins enter the trade annually.


Cobra, Python and Rat Snake

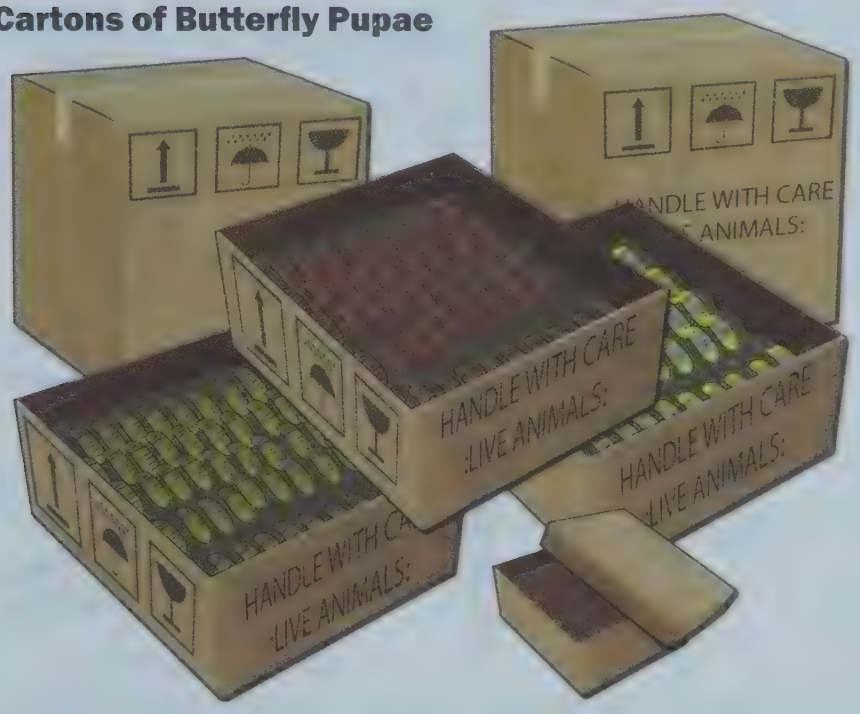
- There are reports of Crocodile poaching and smuggling from Andaman & Nicobar Islands.
- In India, domestic trade is prevalent in Cobras and other snakes with snake charmers and also Spiny-tailed Lizards for medicinal purposes with traditional roadside vendors.
- The international trade in water monitor skin ranges between 1 to 1.5 million annually.
- Monitor Lizard is used for various purposes like the skin for drum heads, oil for haemorrhoid treatment and skin against bacterial infection.
- Reptile skins are used for manufacturing wallets, belts, shoes, whips and other leather accessories.

Reptilian Skin Products

- Spiny-tailed Lizard is used by traditional medicine vendors for extracting oil, which allegedly has aphrodisiacal properties.
- Under the Wildlife Protection Act and CITES, all the following reptiles are protected by law, trade in these species is illegal - Marsh Crocodile, Salt Water Crocodile, Common Monitor Lizard, Yellow Monitor Lizard, Rock Python, Cobra, Rat snake, Russell's Viper.
- Processing centres of reptile skins in India are Agra, Kanpur, Kolkata, Indore, Puri, Pune, Mysore and Chennai.

BUTTERFLIES

Cartons of Butterfly Pupae



- Butterfly plaques used as drawing room hangings, ornaments, pen holders, table mats and other decorative items are sold in many countries.
- Also used as entomological research specimens to various countries, these usually end up in museums and in private collections.
- Dead specimens are mostly traded to Germany, Japan, Switzerland, England and USA.
- Live specimens, eggs and pupae by the butterfly houses are traded to USA, Japan, Europe, Malaysia and Singapore.

Gift Articles

- Trade in butterflies is estimated to be worth US$ 100 million per year.
- Taiwan exports upto 500 million butterflies per year, many of them collected from all over Asia.
- Banded Apollos found in Ladakh region, are much sought after butterfly species. One specimen can fetch upto thousands of dollars in Europe and USA.
- Butterflies of the Swallowtail group are specifically targetted by collectors. Butterflies such as Bhutan Glory, the Apollos, Kaiser-I-hind, Birdwings and other Swallowtails are threatened and rare.

Butterfly Cabinet

- Main collection centres- Himalayan and Trans Himalayan region, North East India, Andaman and Nicobar Islands.
- The trade routes are - (1) from Delhi to Germany, England, USA and Switzerland Japan, Taiwan, Malaysia, Singapore (2) from Mumbai to Europe (3) from Guwahati to Japan Taiwan, Malaysia and Singapore. While Delhi receives contribution from Mumbai, Jammu & Kashmir, Himachal Pradesh, Kolkata receives from Chennai, Sikkim, Shillong and Chennai receives from Andaman & Nicobar Islands.

ANTLERS AND HORNS

- Antlers are characteristic of deer while antelopes have horns. Some of the endangered deer and antelopes are Kashmir Stag, Swamp Deer, Musk Deer, Four-horned Antelope, Black Buck.
- Antlers are branched, solid and are usually shed every year unlike horns, which are hollow, unbranched and permanent.
- The antlers of deer such as Chital, Sambar, Barking Deer and Swamp Deer are found in the trade.
- The main export of antlers or products from India is to Europe, Australia, East Asia and USA.

Antlers and Horns

- In 1993, India exported antlers worth more than US$ 1,00,000 to Taiwan alone.
- Major supplier states are Andhra Pradesh, Madhya Pradesh and Maharashtra.
- Total collection is estimated to be 20 tons annually.
- Antlers are used in cutlery handles, pistol butts and buttons.
- Also used as whole antlers for trophies or shields for decorating houses.
- They are also reported to be used in traditional oriental medicines.

SHELLS

- Shells are divided into five main classes such as gastropods, bi-valves, tusk shells, chiton and cephalopods. About 80% of living molluscs belong to the `Gastropod' class. Bi-valves comprise the second largest class followed by far less numerous minor classes like tusk shells, chitons and cephalopods.
- In 1996-97, India exported 668 tons of variety of shells worth Rs. 5 crores.
- Often the prohibited species of shells and corals are mixed with other general permissible consignments or labelled as 'shells' to avoid detection by the authorities.
- Commercial Trochus, a coral reef species, was once used to provide material for buttons and was exported from India. It is still being fished in small quantities for decorative purposes.
- Turban shells provide mother-of-pearl for making decorative buttons, beads and jewellery. They are much in demand for making curios and utilitarian articles.
- Conches are collected for decorative purposes.

Turban Shells

Decorative Shells

- Sacred chanks are exploited for the popular bangle industry in West Bengal. Imported from Sri Lanka, it is one of the most traded shells. It is also used in making ornaments and in religious occasions (blown) for producing 'Shankh dhwani'.
- Sinistral shells are highly priced for their rarity, also known as `Valmpuri chank'.
- Giant Clams are the largest bivalves in the world and live in tropical seas in the Indo-Pacific. They are mostly exploited for edible purposes by the local population.

AQUARIUM FISHES

- Asian countries supply most of the freshwater aquarium fishes in the market today.
- As many as 340-500 million fish are kept as pets in USA alone, more than three times the number of dogs and cats combined.
- USA imports some 125 million ornamental fish per year
- Over 2,000 species are present in the Japanese trade in aquarium fish.

- One study indicates that only 300 non-food fish out of the 1,000 taken from the sea survive on an average.
- The total annual world market for aquarium fish is growing 10-15% per year.

Fish Breeding Centres

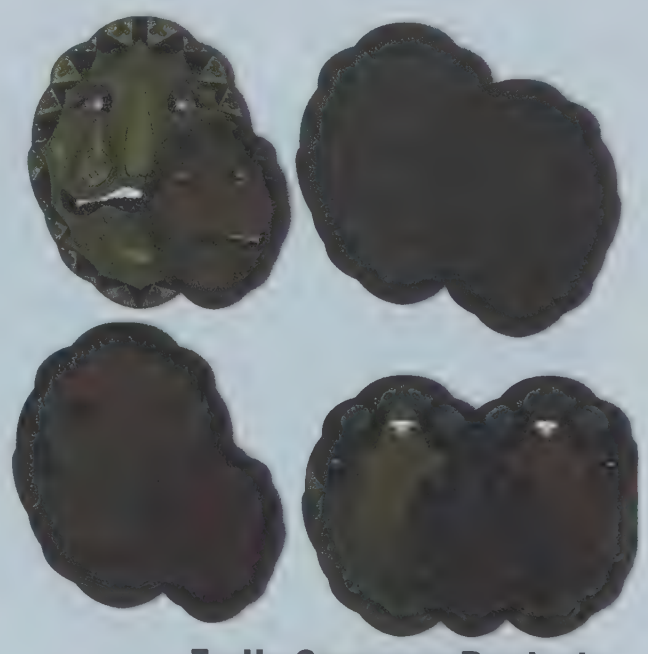
- Singapore is the world centre for breeding tropical aquarium fish for trade. It annually exports over 150 million popular fishes. The popular species are Guppies, Mollies, Swordtails, Tetras, etc.
- India exports Aquarium fish annually to various countries including USA, Japan, Malaysia, Nepal, Singapore, Netherlands, Germany and others.

TURTLES AND TORTOISES

- In India, there are 16 species of freshwater and semi-aquatic turtles, six species of soft-shell turtles, four species of land tortoises and five species of marine turtles.
- All our marine turtles are endangered. Of the five marine turtles, three are traded mainly for meat.
- Although international trade is banned, there are reports of smuggling turtles from India to Bangladesh for meat and of live star tortoises mainly to the Middle East for the pet trade.

Tortoises for Sale

- Turtles are exploited for food as meat, fat and eggs. This trade is more prevalent in the states of West Bengal, Orissa, Bihar, Uttar Pradesh and the North-east.
- The hub of turtle trade for meat is the Gangetic belt including U.P., Bihar, part of M.P. and North-eastern states. The turtles are transported to West Bengal from these areas and further smuggled out to Bangladesh through the land border.
- A star tortoise can fetch high price in the international market. In India, star tortoises are also a popular pet species.
- Small hatchlings of the Indian tent turtle and Indian roofed turtle are sold for domestic aquarium trade.
- Major centres for smuggling of tortoises for the pet trade are Chennai, Bangalore, and Ahmedabad. Both tortoises and turtles are traded as pet to countries like Europe, Middle East and S.E. Asia.
- They are also used in traditional medicines for example; the shell is used for eye treatments, blood, meat and gall bladders as cures for stomach and skin disorders and for treating tuberculosis.
- Shells are used as decorative items with silver linings and paints, also used in the making of combs and brushes.
- Tortoise shell souvenirs are made up of cleaned-out or stuffed carapaces (shell) and plastrons of either land tortoises, aquatic turtles or marine turtles, sometimes incorporating leather, wool, horn, bone, rubber, plastics, metal and wood.
- Hawksbill turtle shell is used for making handbags, comb-handles, fancy hair-clips, etc. A handbag of Hawksbill shell decorated with corals, pearls and more, which is an attraction for foreign tourists, can cost up to a lakh of rupees in India.


Turtle Carapace Products

- Traditionally, tortoise-carapaces were used as sounding boards for musical instruments.
- The turtle skin, which is most commonly used in leatherwork, is the scaly area that covers the front flipper of marine turtles.

WHALE SHARKS

Whale Shark

- Whale sharks are the largest fish in the world, reaching at least 12 m in length and weighing 13 tons, about as large as an adult grey whale.
- Whale shark is the largest species of shark, declared vulnerable under the IUCN Red List.
- India exported about 200 tons of whale shark meat in 1995-96. India banned whale shark hunting in 2001, making it the first fish to be protected under the Wildlife (Protection) Act, 1972.
- The main consumer is Taiwan where its fresh frozen meat is very popular.
- Fins are also exported and used for making fin-soup, though the fins of whale sharks are not considered to be of high quality. Whereas, fins from other species of sharks fetch a high price and are considered to be the most highly priced seafood item.
- Finning is a gruesome act where the fishermen sometimes cut all the fins after which the living animal is thrown back to the water, to die a slow and horrifying death.
- Most of the fin-trade is undocumented as it goes in personal baggage with individual passengers to Singapore, Hong Kong, Japan and others.
- Whale shark liver is used to extract an oil, which is consumed locally.
- Shark is often a luxury food in restaurants, whether we choose to eat shark or not, it is important that shark fishing be controlled. If not, these fascinating animals could disappear from the world's oceans.

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Whale Shark Fins

MOST POPULAR WILDLIFE PRODUCTS

1. Tiger Products

- Tiger skins have a ready market in India and abroad.
- In 1993 alone, 475 kg of tiger bones and 13 tiger skins were seized.
- Tiger parts that are used in the trade include whiskers, eyeballs, brain, bones, claws, skin, hair, penis and blood.
- Skins and heads are used as trophies, claws are used as talismans; bones and skulls are used in traditional oriental medicines; fat is used in balms and potions, penis is used as an aphrodisiac and whiskers are thought to cure toothaches.

Ivory Products

2. Ivory

- Only male Asian elephants have tusks. The mean weight of a tusk is approximately 9.5 kg.
- From 1977-86, about 190 pair of tusks were lost to the ivory trade from Kerala, Karnataka and Tamil Nadu. In 1981-82, 64% of elephant mortality rate in South India was due to poaching.
- In 1989-1995, 41,592 kg of ivory was seized from various countries. In the same period, there were 141 seizures of ivory in 24 countries. Out of these 13 were in India.
- Worked ivory is used in the form of bangles, bracelets, statutes, carved tusks, chessboards and others. Powdered ivory is used for medicinal purposes.
- The erstwhile dealers of ivory and ivory products have a sizeable stock of ivory with them, which is sealed. Following a ban on ivory trade in 1991, display of ivory items in commercial outlets is prohibited.

3. Rhino horns

- Due to the trade in Rhino horns, five species of Rhino (three in Asia, two in Africa) are endangered. Between 1994-1996, 227 Rhinos were killed in Kaziranga National Park (Assam).
- Mean weight of Asian Rhino horn is 800 gm to 1 kg. Each horn is worth about lakhs in India and much more outside the country.
- Asian Rhino horn or "fire horn" costs 5-10 times more than African Rhino horn or "water horn" in Taiwan and China.
- The Asian Rhino horn is used in traditional medicines in countries like China, Taiwan, Japan and South Korea.

Rhino Horn

Rhino Horn Products

- African rhino horns are carved into dagger handles in Yemen and Oman. The traditional daggers called as *'Jambias'* and *'Khanjars'* have a carved rhino horn handle. In addition, blades, belts and shields are also made using the rhino horn.
- It is also used in rings as a lucky stone and as an alleged aphrodisiac.
- Also used in six principal Tibetan medicines marketed in India and as cutlery to detect poison.

4. Shahtoosh

- The wool marketed as the "Shahtoosh" or the "ring wool" is the under wool of the Tibetan Antelope. Very fine quality shahtoosh shawls are woven from this wool. The animal is commonly known as Chiru and in India, the migratory population is known to occur only in Daulatbeg oldi area in extreme north-eastern corner of Ladakh during summer.
- A Shahtoosh shawl can pass through a ring, thus the name 'ring shawl'. Shahtoosh is collected from Tibet and woven into shawls in Kashmir.
- Only about 150 gm of wool is procured from a single animal.
- Once abundant, it is estimated that not more than 200 Chirus visit the region during summer. Outside Indian limits, 40,000-50,000 Chiru are reported from the Tibetan plateau. Hunting for meat, horns and wool is a major threat to the Chiru. As it is protected under the Wildlife Protection Act, trade in its wool is banned.

- Shahtoosh shawls are highly priced in the international market, depending on workmanship.
- In Delhi, during 1993-1998, there have been at least eight seizures, which included 600 kg of wool and 250 shawls.
- The focal point of the trade route is Delhi, which receives raw materials from Srinagar, Leh, Nepal, Darjeeling and the finished goods are supplied to Europe, USA, Japan and Hong Kong.

Chiru Antelope

5. Musk

- Musk is extracted from the musk pod of the male musk deer, an endangered deer found in the Himalayan region.
- The musk gland helps in maintaining social contact among the deer. Unfortunately, the secretion from this gland is a valuable fixative in the perfume trade and the hunters for its musk pod heavily poach this shy deer.
- Annual trade in musk is estimated to be in millions. International price for musk is very high.

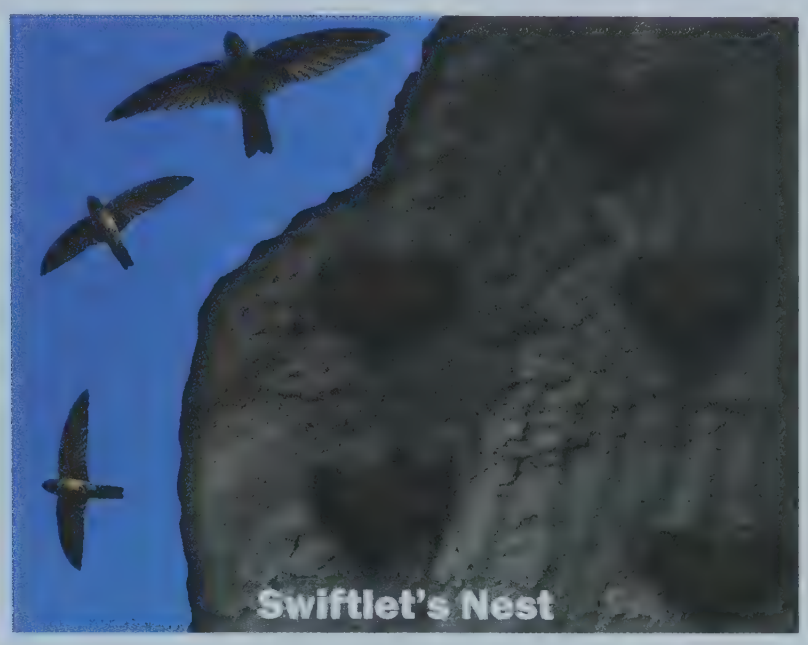
Musk Deer

- Musk is used in making perfumes, soaps and in medicines.
- In China, several factories are reported to be using musk. A scheme has been in operation to keep Musk Deer in captivity and extracting the musk secretion from the male deer without having to kill them. However, it is not known whether the Chinese have succeeded in breeding this animal in captivity.
- The trade routes are Amristar, Delhi, and Kolkata from where supplies go to Pakistan, Katmandu, Myanmar, Hong Kong and Japan.

Water and air, the two essential fluids on which all life depends, have become global garbage cans

by Jacques Cousteau

LESSER-KNOWN WILDLIFE PRODUCTS


Swiftlet's Nest

1. Swiftlet's Nest

- Swiftlet's nests are made of mucilaginous secretions from a pair of glands in the mouth (of some species of swiftlets) that enlarge during the breeding season. The nest is constructed by using saliva, feathers, grass and moss.
- The nest of pure saliva (50% protein) is a much prized as a culinary item by the Chinese for bird's nest soup; are commercially exploited.
- A collection of edible swiftlets' nests has been documented from the Andaman & Nicobar Islands.
- The collection of nests has caused a decline in the population of Swiftlets, estimated to be more than 80% over the last decade.
- The collection of nests goes unabated and total nest collection is anywhere between 400-700 kg per annum.
- A kilogram of top quality white nests can cost in thousands in Hong Kong.
- In 1989, Japan imported 19.9 million nests with a net weight of 159 m tons.
- Singapore is the major destination for nests from Andaman and Nicobar Islands whereas, Hong Kong, Thailand and other Southeast Asian countries are also recipient of smuggled nests from India.
- The nests of four species of swiftlets are harvested for consumption as food, tonic and medicine and of these, two species are found in India.
- Swifts and swallows are the only birds not protected by Indian law, although local rules prohibit trade.

2. Sea Horse

Sea Horse

- At least 10 species from the Indo-Pacific are used in traditional Chinese medicine.
- India is one of the largest known exporters and it exported nine tonnes of seahorse in 1996-97.
- China is the single largest user of seahorses with total annual consumption of six million seahorses.
- At least 32 nations around the world are involved in this trade. Along with China, Hong Kong and Taiwan are the main importers.
- Aquarium trade accounts for another million seahorses.
- Seahorses sold in Hong Kong are bleached and fetch a greater price. The cost of bleached seahorses is more than unbleached.

- The main market for live seahorses, especially for the aquarium trade, is North America, Europe, Japan and Taiwan.
- Besides being used in medicines, seahorses are used as souvenirs and in traditional jewellery.
- In Taiwan, it is used as an aphrodisiac.
- Also used as live specimens for aquariums and sometimes as food.

3. Sea Cucumber

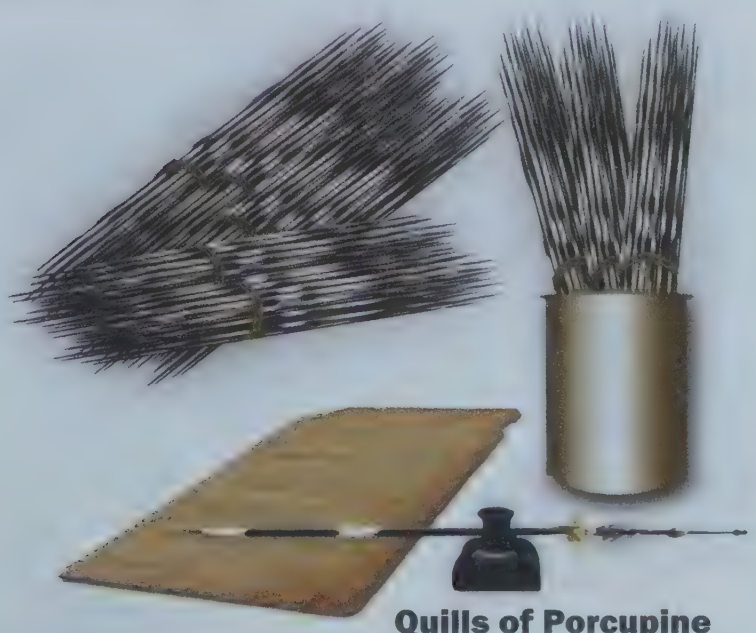
Sea Cucumber

- All over the world, there are 650 species of sea cucumbers. Seas around India have nearly 200 species of which 75 are from shallow waters within depth of 2 m. Of these, 13 species are of commercial value.
- Popularly known as *Beche-de-mer*, it is used for edible purposes.
- In 1989, India exported crores worth of *Beche-de-mer* mainly to Singapore.
- *Holothuria scabra* and *H. spinifera* are the two most traded and endangered species.
- Singapore gets its imports from Southeast Asia; Hong Kong gets its supplies from West Indian Ocean. Singapore re-exports to Malaysia and Hong Kong to Thailand and USA.
- Singapore consumes 80 to 100 tonnes of sea cucumber annually. Philippines is the largest supplier to Singapore. Other suppliers are India, Sri Lanka and Sabah.
- In 1982, Government of India put a ban on the export of *Beche-de-mer* below the size of 7.5 cm.
- In Andaman & Nicobar Islands, sea cucumber fishery is banned.

Hog and Mongoose Hair

4. Hairs, Bristles, Scales and Feathers

- Bristles of hogs, pigs and mongoose are used in paintbrushes and shaving brushes.
- In 1992, the United Kingdom alone imported nearly 10,000 kilos of bristles from India.
- Bristles can cost upto thousands per kg in the international market.
- While Kanpur and Jabalpur are the main trade centres for bristles, Mumbai is the main shipping port.
- The scales of pangolin are used in traditional medicine.
- These scales are also shaped into rings considered to be magical charms.



Quills of Porcupine

but there is an exemption on the domestic trade in naturally shed peacock feathers and articles and trophies made from them. However, export of feathers or articles made from them is completely banned.

- Feathers are sold in the form of partition screens, belle dress and hand fans.
- Feathers of some other birds are also smuggledout. These include, Grey Jungle Fowl, Red Jungle Fowl, Green Pea fowl, Peacock Pheasant and Egrets.
- Some communities eat the flesh of pangolin.
- Quills of porcupines are used in some traditional medicines.
- These are also used for writing purposes.
- The Indian Peafowl is the national bird of India and is protected under Schedule I of the Wildlife Protection Act, 1972. Under this, poaching of the species is prohibited

Feather Products

PLANTS IN TRADE

1. Medicinal Plants

- According to the World Health Organization (WHO), more than 4 billion people rely on herbal medicines to some extent.
- It is estimated that 25% of all prescription drugs are based on plant-derived chemicals. The WHO has listed 21,000 plants that have reported medicinal uses around the world.
- India and Brazil are the largest exporters of medicinal plants.
- In India, the collection of medicinal plants continues unabated especially in the North-east, the Himalayas and the Western Ghats.
- India has a rich medicinal plant flora of some 2,500 species. Of these, 2,000 to 2,300 species are used in traditional medicines while at least 150 species are used commercially on a fairly large scale.
- The Himalayan Yew *(Taxus wallichiana)* is much in demand in USA and Germany. In 1994, USA imported 1,300 tonnes from India. Some quantities of this plant are smuggled into India from Nepal.
- The notion that a plant collected from the wild is more efficacious than a cultivated one; pose problems for plant conservation. Hence, the wild plant may fetch up to three times as much as a cultivated variety.

- Medicinal plants are traded as chips, pulp, bark, fruit, root, wood, herb, flower, seed, petals, rhizomes, nuts, shells and others. The medicines can be in the form of extracts, capsules, powder, balm, tablets and others.
- Plants that are in trade are Indian Birthwort *(Aristolochia indica)*, Himalayan Mayapple *(Podophyllum hexandrum)*, Kutki *(Gentiana kurroo)*, Indian Serpent root *(Rauvolfia serpentina)*, Yam *(Dioscorea deltoidea)*, Himalayan Spikenard *(Nardostachys grandiflora)*, Golden Moss *(Cibotium barometz)*, Yew *(Taxus wallichiana)* and Kutki *(Picrorhiza kurroa)*. These medicinally important plants are highly endangered and are protected under Wildlife Protection Act.

Plant Parts used as Medicine

Indian Serpent Root

- The Indian Serpent root is used as a valuable treatment for intestinal disorders, as an anti-hypertensive and sedative. Indian Birthwort's roots and rhizomes are used for treatment of leucoderma and the leaf juice is believed to be an antidote for cobra bite. Poisonous tubers of Yam are the main raw material for the production of diogenin in India. Also used as vermifuge. Leaves and bark of Yew are used for manufacturing taxol and baccatin.

2. Ornamental Plants

- It is estimated that 1 in 10 recorded wild plant species is either rare or endangered.
- The world market for wild plants, for decorating houses and gardens, is large as trade among collectors adds to the peril of species that are rare and difficult to cultivate.
- Pressures due to over collection have been disastrous for plants like cycads as well, with 50 of the 130 species being declared vulnerable or endangered by the IUCN.
- Orchids are the plants that are most in demand in the world trade due to their spectacular beauty and exotic aura. Orchids, like the very rare Lady's Slipper *(Paphiopedilum rothschildianum)*, are sold at high price.
- Lady's Slipper orchids and the red and blue Vandas are highly prized among Indian orchids.

Slipper Orchid

Pitcher Plant

- Orchid trade centres in India include Kalimpong, Shillong and Trivandrum.
- Wild orchids are often smuggled out of the country as cut flowers by wrongly declaring them as lilies or other exotic flowers.
- Artificial propagation of orchids is a complex and time-consuming affair and there is thus, an ever present demand for wild orchids.
- It is estimated that over 10 million cactus plants and three million orchids enter the world trade each year. Of these, 30,000 cacti and 1.5 million orchids are obtained from the wild.

- Rare Cycads *(Cycas beddomei)* are also in the plant trade, many of which come from wild sources.
- Genus *Nepenthes* (Pitcher Plants) comprises roughly 70 species of carnivorous, usually climbing plants, which are distributed from Madagascar and the Seychelles to India, Australia and New Caledonia. In India, *Nephenthes khasiana* is the only species occurring in wild, confined to the Khasi hills in Assam, North-eastern India. Young plants are available in the trade.

Cactus

- Carnivorous plants such as the Sundew and Bladderwort are also traded, with over a million plants sold every year in Europe alone. There are artificially propagated specimens in the trade although wild collection continues.
- To guard against loss of wild stocks, some of the more popular horticultural plants including all the orchids and cacti; several aloes, palms and cycads; and a few insectivorous plants are listed under CITES and protected by national laws.

HOW CAN YOU HELP?

If you find any wildlife trade in your locality, you can help book the culprits by reporting it to the concerned body. Wildlife trade in India is primarily the jurisdiction of the Directorate of Wildlife Preservation, Government of India. Any offences detected, information received and others. must be conveyed to their officers at the earliest. Any offence can also be brought to the notice of the local Forest Officer (Wildlife Wing) or the Chief Wildlife Warden (If the offence is that of the Wildlife Protection Act) or the Customs Officer (if the violation is of the Customs Act or Export Import Policy). The local police, or paramilitary can be of assistance in special cases.

Given below are few of the addresses which could be contacted:

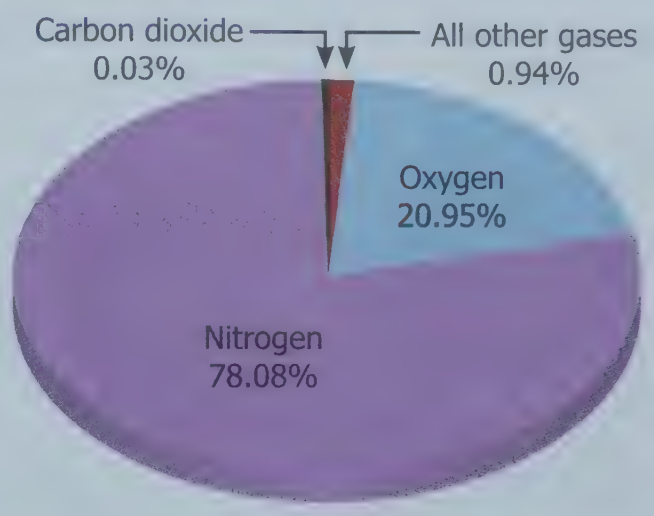
CITES Management Authorities Additional Inspector General (Wildlife) MOEF Government of India Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi- 110003. Tel: 91-11-24362785/ Fax: 24363918	Inspector General of Forests MOEF Government of India, Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi - 110003. Tel: 011-24361509/Fax: 24360678
Regional Deputy Director (WCCB) Northern Region Ministry of Environment & Forests Wildlife Regional Office Barracks No.5, Bikaner Office, Shahjahan Road, New Delhi - 110011 Tel.No.: +91-11-23384556 Fax: +91-11-23386012 Tel: 011-4384556 / Fax: 4360678 Email: rddnr@vsnl.net.in	Regional Deputy Director (WCCB) & CITES Asst. Management Authority Western Region Ministry of Environment & Forests Wildlife Regional Office 11, Air Cargo Complex Sahar, Mumbai - 400099 (India) Telefax: +91-22-26828184/ 022- 6328529 Email: rddwr@vsnl.com
Regional Deputy Director (WLP) Eastern Region Ministry of Environment & Forests Wildlife Regional Office Nizam Palace, 2nd MSO Bldg. 234/4, AJC Bose Road, Kolkata - 700020 (India) Telefax: +91-33-2247869 Tel: 033-478698 / Fax: 378387	Regional Deputy Director (WCCB) Southern Region Ministry of of Environment & Forests Wildlife Regional Office, C-2A, Rajaji Bhawan, Besant Nagar CGO Complex, Chennai 600090 Tel.No.: +91-44-24916747/ 8253977 Email: rddwl@md4.vsnl.net.in
Chief Commissioner of Customs (Bangalore) Central Revenues Building P.B. No. 5400, Queen's Road, Bangalore - 560001. Tel: 080- 22867990 E-mail: cccusbz@rediffmail.com	Chief Commissioner of Customs(Mumbai) 2nd Floor, New Custom House, Ballard Estate, Mumbai - 400 001. Tel. (022) 2262 0091 Fax (022) 2261 0027

Environmental Issues

This section deals with common environmental issues. The information is directly linked to the school syllabus, therefore it will be easier for you to use the information directly in the classroom.

WHAT IS ENVIRONMENT?

- Environment is the sum of all external conditions affecting the life, development and survival of an organism.
- All living and non-living things that occur naturally on Earth constitute the natural environment. It is inclusive of constructed surroundings for human activities.
- It consists of abiotic/non-living factors e.g. air, water and biotic/living factors e.g. plants, animals.
- The sun's energy plays a vital role in forming and shaping up the environment.
- The components of Earth are Lithosphere, Hydrosphere, Biosphere and Atmosphere.
- The atmosphere is the body of air which surrounds our planet. It comprises of 78.08% nitrogen, 20.95% oxygen and a small amount of carbon dioxide (0.03%) and other gases.



Components of the Atmosphere

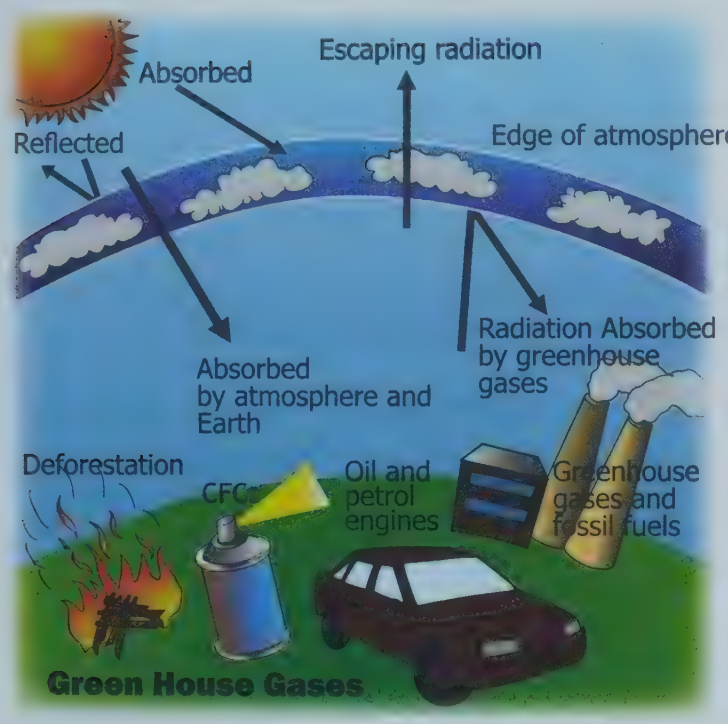
DYNAMICS OF ENVIRONMENT-GRADUAL CHANGES

- The Earth's atmosphere initially consisted of only hydrogen and helium; gases like nitrogen, sulphur dioxide, carbon dioxide and water vapour were added later by their out-gassing from the Earth's interior.
- Oxygen was added later by photosynthesis and photo-dissociation of water vapour. Ozone, which shields Earth from the sun's ultraviolet rays, was later formed from oxygen.
- The water vapour was condensed during the Earth's cooling and formed clouds which poured on Earth as rain and got collected in low-lying areas of the Earth's crust forming oceans.
- A thin crust was formed over the Earth by solidification of the lava flowing from the molten interior, which must have melted and solidified repeatedly.
- Shortly after the crust formation and appearance of the oceans, life began on Earth.This apparently occurred 3.8 billion years ago.
- Initial life forms seem to have been one-celled organisms confined to Earth's oceans. Complex forms formed later when electric discharge produced by the rainfall and thundering of clouds led to lightning whose sparks caused fusion of elements.
- The rainfall also caused weathering, breaking and altering of the rocks to form a continental landmass "Pangaea". This then broke into Laurasia in north and Gondwanaland in south, with various sections drifting apart to form the present-day continents.

TRIASSIC 200 million years ago

- Disturbance in plate tectonics caused Gondwanaland to separate. The Indian Sub-continent then sandwiched between Africa and Australia-Antarctica landmass, separated, and moved northwards, colliding with the Asian continental plate, resulting in the formation of the Himalayas.
- Ice ages are periods of time when large areas of Earth's surface get covered with ice sheets. The movement of Earth's plates, reduction of atmospheric carbon dioxide and changes in Earth's orbit are three major causes of ice ages.
- Also, Ice Age refers to the last major glaciation that occurred in North America and Eurasia, from 2 million to 11,500 years ago, during the Pleistocene period. Animals like the mammoth, the saber-toothed tiger, the dire wolf and the snowshoe hare lived during the Ice Age.
- Fluctuations in the Great Ice Age climates from cold and moist to warm and dry affected massive environmental changes.

CLIMATE CHANGE



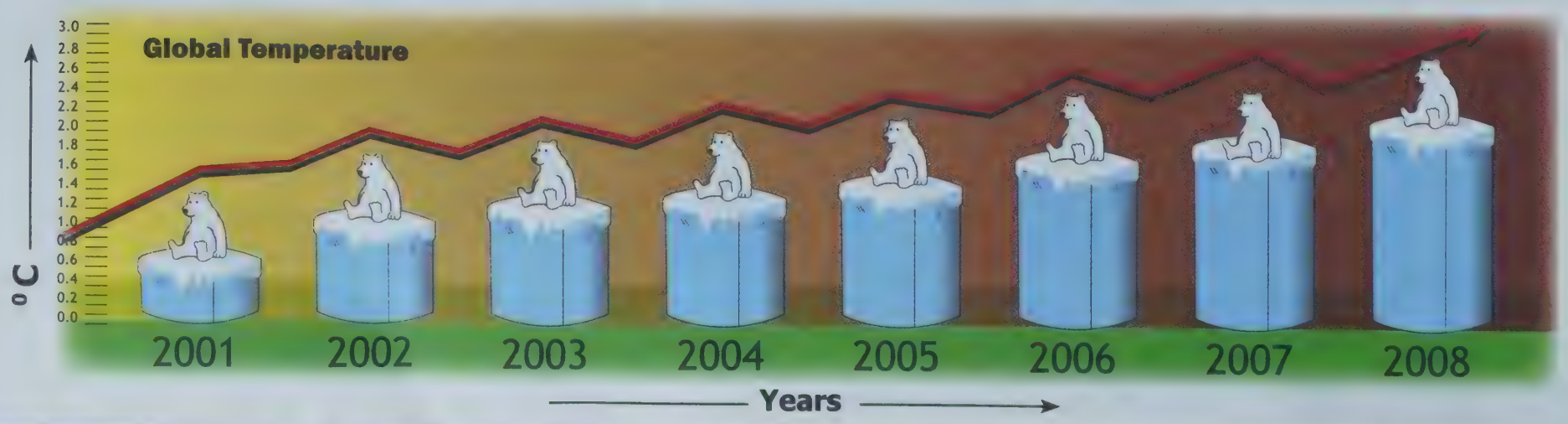
- Climate Change is defined as changes in our climate due to man made activities.
- The main human influence on global climate is emissions of the key greenhouse gases (GHG). The accumulation of these gases in the atmosphere strengthens the greenhouse effect.
- It has been observed that mean global temperatures are likely to rise between 1.1°C and 6.4°C (with a best estimate of 1.8°C to 4°C) above 1990 levels by the end of this century, depending on our emissions. This will result in a further rise in global sea levels of between 20 and 60 cm. by 2100.

- *Impacts of climate change:*

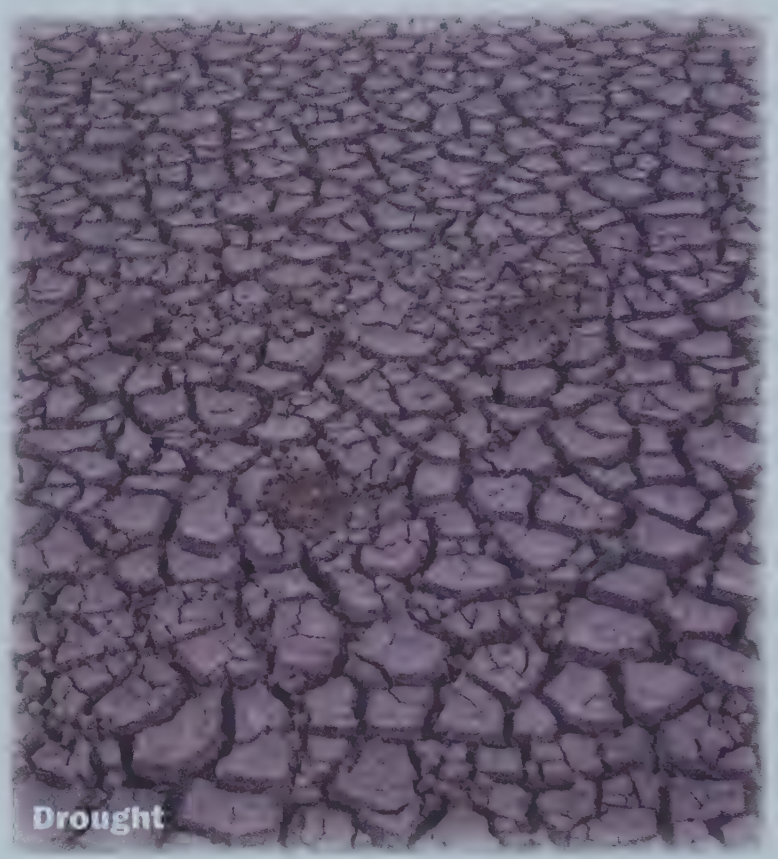
➡ It is estimated that India's climate would become warmer due to increase in atmospheric carbon dioxide. The average predicted temperature changes may be in the range of 2.33°C to 4.78°C.

➡ Due to global warming, the ice caps have begun to melt at a much faster rate. The melting of ice at the poles has caused ocean levels to rise, coastal areas and small islands to submerge.

➡ Eleven out of the last twelve years rank among the 12 warmest on record. The year 2008 has been the 10th hottest year marking the end of a decade of ten hottest years since 1997.



- Some of the recent examples of extremes of weather include temperature exceeding 50°C in Western India in 1994, malaria epidemic in Surat following heavy rainfall in same year. Mumbai in Maharashtra experienced 944 mm of rainfall in July 26 and 27 in 2005 in which over 1,000 lives were lost and property worth INR 170 billions destroyed. In 2006, Surat in Gujarat, Barmer in Rajasthan and even Srinagar experienced serious floods during monsoon. Meanwhile droughts have become far more common. Consecutive droughts between 2000 and 2002 saw 11 million people getting affected in Orissa.
- Climate change presents a significant challenge for India and to the international community. There are also enormous opportunities if we are willing to take action. Government, business and individuals all have a part to play, and all of us can benefit from rising to the challenge of climate change.
- The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). Its role is to assess the scientific, technical and socio-economic information relevant for the understanding of the risk of human induced climate change.
- India is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Government of India attaches great importance to the Climate Change issues.


Drought

- India's commitment to meet the challenge of climate change and its impact on health got a boost when the Indian Prime Minister announced the formation of a high-level advisory group to coordinate national plans on climate change issues. Labeled as Prime Minister's Council on Climate Change, the Council will coordinate national action plans for assessment, adaptation and mitigation of climate changes, facilitate inter-ministerial coordination and guide policy.
- As an individual each of us can help in mitigating the impact of climate change by the following:

- Be an informed citizen and to try learn more about your local environment.
- Pick up natural signals such as early bloom in the plants, late breeding period in birds, vanishing wild patches of vegetation etc.
- Try to probe into the cause by consulting an expert.
- Watch your life style pattern, check which action of yours is an environmental concern and change it accordingly.
- Discuss climate change at home and office, make more people aware of the consequences and precautionary measures to be undertaken.

NATURAL DISASTERS – SUDDEN CHANGES

- Volcanoes are vents in the Earth's crust, which spew out burning gases and molten lava and are generally found where tectonic plates are pulled apart or come together.
- Volcanic eruptions inject water vapour, carbon dioxide, sulfur dioxide, hydrogen chloride, hydrogen fluoride and ash into the stratosphere. In the past century, several such eruptions have led to a decline in the Earth's average surface temperature up to ½ °F for periods of 1-3 years.

- The Indian Peninsula or Deccan Plateau was formed by such volcanic eruptions 66 million years ago and accounts for the black soil found there.
- Earthquakes are caused by the shrinking of the Earth, shifting of continents and sudden jerks in the subterranean tectonic plates.
- The Pakistan earthquake on 8th October 2005 was result of fault-lines in the Indian tectonic plate that moves northwards into the Eurasian continental plate at the rate of 40 mm/year.
- After the Gujarat earthquake on January 26, 2001, measuring 7.7 on the Richter scale, local people reported a mix of water and sediments (i.e. dewatering) fountaining from the Earth. Dewatering may result from intense ground shaking in regions with shallow water tables.
- Tsunamis are caused by earthquakes, submarine landslides and submarine volcanic eruptions and very rarely, by large meteorite impacts in the oceans, which generate giant waves.
- The tsunami that took place on December 26, 2004, in the Indian Ocean was due to an earthquake measuring 9 on the Richter scale. The shores of Indonesia, Sri Lanka, South India, Thailand and other countries were devastated by sea waves up to 30 m in height.
- Hurricanes are huge tropical cyclones that originate over oceans near the equator. The winds blow in a cyclic manner - anticlockwise north of the equator and clockwise south of the equator.
- Forest fires are generally caused when the weather is dry and hot. They could be caused by lightning, human carelessness, arson, volcano eruption, pyroclastic cloud from active volcano, heat waves, droughts, cyclical climate changes such as El Niño.
- Such natural disasters can change the topography of the region through land slides and avalanches, bury large areas under ash, add lethal gases to the atmosphere, bring about soil erosion and more.

Forest Fire

AIR POLLUTION

- Air Pollution- 'The presence of one or more contaminants in the atmosphere in such quantity and for such duration as is injurious, or tends to be injurious, to human health or welfare, animal or plant life.'
- Its major sources are anthropogenic sources e.g. automobiles, industries, nuclear weapons and natural sources e.g. carbon monoxide from wildfires, volcanic activity and others.
- The major effects of air pollution on our environment are Green House effect, formation of ozone hole in the atmosphere, Acid rain and others.

- Green House Effect is the phenomenon of certain gases (green house gases) preventing the sun's radiated heat to escape from the Earth, resulting in Global Warming.
- The indiscriminate usage of halocarbons in our daily lives, such as in air-conditioners, refrigerators and aerosols led to the 'ozone hole' in the atmosphere.
- Acid rain results when sulphur and nitrogen oxides come along with the rainwater. It accelerates the decay of buildings materials and paints, e.g. Taj Mahal, and adversely affects biodiversity.

- Every day, the average person inhales about 20,000 liters of air. Air pollution can have serious health effects on humans as well as natural ecosystems.
- Smog, formed by mixing of smoke and fog is common in highly polluted cities in winter, when the low temperatures keep the air from rising. It is a major cause of accidents on highways since it reduces the visibility and also causes respiratory disorders.

- Bhopal Gas Tragedy: On 3rd December 1984, the leakage of methyl isocyanate from the Union Carbide pesticide plant killed about 3,000 people and maimed thousands.

CNG driven autorickshaw

- We can at least minimize, if not completely stop air pollution, by the following:

➡ Avoid burning garbage.
➡ Rational use of electricity , as a lot of fuel is burnt to produce it.
➡ Planting trees and creating a green buffer.
➡ Using public transport, bicycles or car pools.
➡ Use CNG driven transport systems.

WATER POLLUTION

- A 10 minute shower can use 100 gallons or 378 liters of water while there are 1.8 billion people in the developing world (excluding China) without access to fresh water!
- 75% of the pollution entering oceans worldwide come from inland human activity which comprises of 14,000,000,000 lbs. of sewage, 100,000,000 tons of plastic, 165,710 tons of ship garbage, 1-10,000,000 tons of oil.
- Nearly 70% of India's available water is polluted, causing waterborne diseases like typhoid and cholera which are responsible for 80% of all health problems and ⅓rd of all deaths in India.
- More than 90% of the world's total supply of drinkable water is ground water while less than 1% of it is from fresh water which is readily available for direct human use.

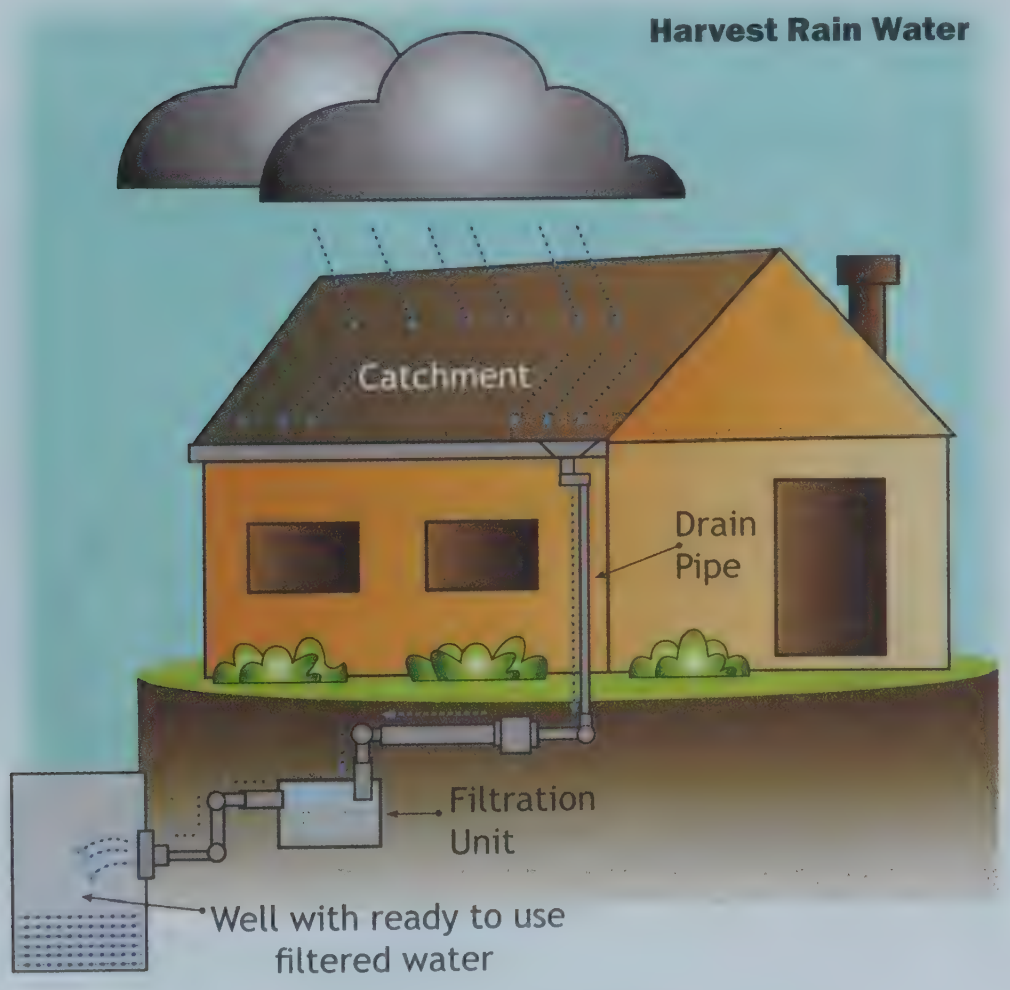
Water Pollution

- Water pollution sources are broadly classified as a) Point source (harmful substances emitted directly into a water body) b) Non-point source (delivers pollutants indirectly through environmental change).

- Agricultural run offs and untreated sewage lead to wastes from households-biodegradable e.g. organic matter and non-biodegradable e.g. plastics; being dumped into water bodies.
- Accumulation of excess of nitrates and phosphates (from fertilizers) in the water stimulates algal blooms, depletes dissolved oxygen which leads to the killing of aquatic life.
- Accidental oil spills can cause drastic damage to the water bodies as they can easily spread, float on the water surface, pose a threat of fire and lead to a decrease in oxygen content of water thereby badly affecting marine life.

Sewage Waste

- According to a report in the Economic Times, industrial discharge into the Ganges is growing at the rate of 8% per year. At this rate, by 2020, nearly 2 billion liters of industrial effluents would enter the river every day - and close to 4 billion by 2030.



- We can aid water conservation by:

➡ Reducing wastage, reusing and recycling water.
➡ By practicing rain water harvesting, proper waste management and sewage treatment.
➡ Bioremediation (use of certain bacteria to break down the hydrocarbons of oil spills)
➡ Celebrating festivals in an eco-friendly manner and more.

(Learn more about water conservation in forthcoming section.)

NOISE POLLUTION

- Noise pollution is displeasing human or machine created sound that disrupts the activity or happiness of human or animal life.

Noise levels of common sounds

Pain	130 dB
Aircraft taking off	110 dB
Loud Rock Music	100 dB
Semi Truck (short term hazard)	90 dB
Jack Hammer	80 dB
Traffic (occupational limit)	70 dB
Conversation	60 dB
Background office noise	50 dB
Windmill	40 dB
Quiet bedroom	20 dB
Threshold of hearing	0 dB

- Sources of noise are transportation services i.e. automobile, aircraft and rail noise, loudspeakers, crackers, construction equipment, manufacturing processes and others.
- *Effects of noise pollution:*
  - Loud noises traumatize animals and birds and work upon the nerves of humans.
  - Sleep and speech interference, partial or total hearing loss, pain, cardiovascular problems, annoyance and stress.
  - Noise also makes species communicate louder, which is called Lombard vocal response. Death of certain species of whales, brought on by the loud sound of military sonar have been reported.

- We can reduce noise pollution:

  - Sound proofing materials absorb noise over a wide range of frequencies.
  - Viable solutions include layering wall panels, increasing wall insulation, separate living spaces from common spaces, sound barriers along highways, quieter motorized vehicles.

Noise Pollution

INVASIVE SPECIES AND EXOTIC SPECIES

- Invasive species include both native and non-native species which affect habitats invading economically, environmentally or ecologically.
- Exotic species are non-native species which thrive in the absence of natural enemies and compete with indigenous species for nutrients, air and others.
- Being a stranger, exotics aren't readily accepted by native insect and animals. Also, their introduction leads to the indirect entry of disease causing microbes/insects.

- Invasive species can adversely affect the entire ecosystem.
  E.g. The Water Hyacinth destroys an entire aquatic ecosystem as it proliferates rapidly, choking the water body.
- Some exotic species like Eucalyptus, Australian Acacia and Gliricidia have been introduced in India for afforestation.

LAND DEGRADATION

- Did you know that 2.5 billion tons of carbon is added to the atmosphere because of deforestation, which contributes to global warming!
- In 1950, 10% of Earth's land surface was covered by rainforests of which now only 6% remains. Every minute rain forests of the approximate area on 60 football fields are being felled. At this rate, rain forests will be extinct in 50 years.
- Land degradation (including desertification in dry lands) is estimated to affect at least ⅓rd of the 328-mha geographical area in India.
- Of the world's 5.2 billion hectares of agriculturally used dry lands, 69% is degraded or subject to desertification, according to UNEP.
- The rapid desertification worldwide arises from the increased populations demand to settle on land for agriculture and animal grazing. The main causes of deforestation are overgrazing, over drafting of groundwater, increased soil salinity and global climate change.

- It may be practically impossible to afforest a denuded forest once again because of soil erosion and absence of forest litter to replenish the organic matter.
- The Great Indian Desert (Thar) in Rajasthan is one of the most endangered dry land regions according to United Nations.
- The main factors responsible for desertification in the Thar Desert of Rajasthan are climatic, biotic, and socio-economic.

MINING AND QUARRYING

- Mining activities, whether occurring within or near Protected Areas, can result in large-scale alteration of the environment at landscape and ecosystem levels. The clearing of vegetation is one of the most significant impacts of mining on biodiversity.
- The excavation of the substrate materials and creation of the mine voids also alter the soil profile, hydrology, topography, and nutrient status of the substrate.
- At the landscape level, it leads to alteration of landform features and fragmentation of biological habitats causing population isolation of floral and faunal species.
- Noise and visual intrusion arises from both mining and secondary activities, including transportation. Acid drainage from mines causes severe damage to the aquatic habitats and may alter the spawning grounds of fishes.
- Displacement of human populations due to diversion of land for mining can also trigger unsustainable resource-use pressures in other areas allotted for human rehabilitation.
- In the past several years Kudremukh National Park, Karnataka has witnessed conflict between conservation and mining interests. Iron ore mining has been carried out for the last 35 years.
- Kudremukh Iron ore Company Limited (KIOCL) has been operating in the Aroli and Malleshwara regions of Kudremukh National Park. Besides ravaging the rich flora and fauna, it is causing irreparable damage to water resources. The Supreme Court is in the process of issuing an order to stop mining.

What's the use of a fine house if you haven't got a tolerable planet to put it on...?

by Henry David Thoreau

DAMMING AND LINKING OF RIVERS

In India, construction of various river valley projects from 1950-75 has led to destruction of 5 lakh ha of forested land.

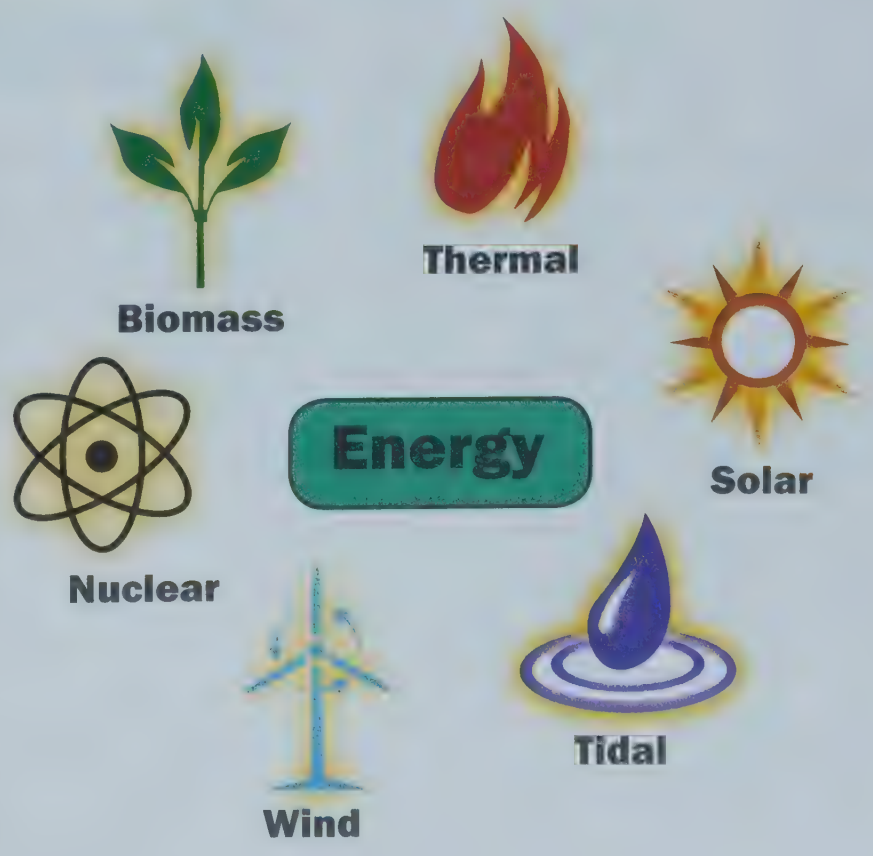
- Many of the dams constructed to meet peoples energy and water requirements have had negative impacts like landslides, soil erosion and variation in the water table.

Dam

- Damming adversely affects the regions biodiversity, decreases the flow-rate of the river downstream and affects aquatic life and riparian communities.
- Inspite of much opposition the Sardar Sarovar Dam was built on the River Narmada.
- It was touted to be Gujarat's lifeline but turned out to be 'India's greatest planned human and environmental disaster'. Thousands of families were ousted and promises of resettling them were not kept.
- Only 15% of households in Saurashtra and Kutch are getting water. There is large-scale water logging in the command area of the Dam during the monsoons.

ENERGY CRISIS

- Sun is the ultimate source of energy. This energy is primarily stored in two forms: Nonrenewable and Renewable.
- Non-renewable energy e.g. fossil fuels can't be recreated in a short period of time and take millions of years to make.
- We are using up the fuels that were made more than 300 million years ago, even before the time of the dinosaurs. Once they are gone they are gone.
- Renewable energy e.g. solar energy, wind energy, tidal energy, nuclear energy, etc. are continuous.
- 89% of energy used for power generation today is indigenous from Coal (56%), Hydroelectricity (25%), Nuclear power (3%) and Renewable (5%) Solar energy segment contributes just 0.2% of our energy production. (Learn more about energy conservation in forthcoming section.)



WASTE MANAGEMENT

Recycle

- Did you know that 40% - 50% of what we throw away is paper!
- Waste management is the collection, transport, processing, recycling or disposal of waste materials which may be solid, liquid or gaseous. It usually refers to materials produced by human activity and is undertaken to reduce effects on heath, aesthetics or amenity.
- It is also carried out to reduce the effect of materials on the environment and to recover resources from them using different methods and different fields of expertise.
- Due to varied lifestyles and consumption patterns, the quality and composition of waste has become more varied and changing. Industrialization and economic growth has produced more amounts of waste including hazardous and toxic wastes.
- We are aware about the negative impacts that wastes have had on the local environment. Waste is now treated as a business opportunity to extract valuable resources within them and to safely process and dispose wastes with a minimum impact on the environment.
- Waste is an underlying theme in many multilateral environmental agreements, seeking justification for concerted local action or broad global consensus. As in the 'mother-of-all-MEAs' - Agenda 21. (Learn more about recycling waste in forthcoming section.)

E-WASTE

E-waste consists of any broken or unwanted electrical or electronic appliance including all secondary computers, entertainment devices electronics, mobile phones and other items.

- Typical computer monitors may contain more than 6% lead by weight much of which is in the lead glass of the Cathode Ray Tube.
- Toxic substances in e-waste include lead, mercury, polychlorinated biphenyls and others.
- Improper recycling and disposal of e-waste can result in dangerous health and environmental hazards from toxic chemicals and persistent pollutants.
- A total of 3.3 lakh tonnes of e-waste is generated annually in India, while an aditional 50,000 tonnes is illegally imported into the country.

E-Waste

ENVIRONMENTAL LAWS

- The Constitution of India clearly states that it is the state's duty to protect and improve the environment and safeguard the forests and wildlife of the country.
- It imposes a duty on every citizen 'to protect and improve the natural environment including forests, lakes, rivers, and wildlife'. Reference to the environment has also been made in the Directive Principles of State Policy as well as the Fundamental Rights.
- In 1980, the Department of Environment was established in India to ensure a healthy environment for the country. It later became the Ministry of Environment and Forests in 1985. The constitutional provisions are backed by many laws-acts, rules, and notifications.
- Environmental law comprises a system of complex and interlocking statutes, common law, treaties, conventions, regulations and policies which seek to protect the natural environment which may be affected, impacted or endangered by human activities.
- Some environmental laws regulate the quantity and nature of impacts of human activities e.g. setting allowable levels of pollution while few others may be preventive in nature and seek to assess the possible impacts before the human activities can occur.
- The Environment Protection Act. 1986 was established to protect and improve the environment (which includes water, air, land, living organisms and properties) and for matters connected therewith.
- The Wildlife Protection Act, 1972 provides for the protection of wild animals, birds, plants and for matters connected therewith or ancillary or incidental thereto.
- The Ramsar Convention On Wetlands, 1971 provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
- The Agenda 21 is a programme run by the United Nations (UN) related to sustainable development. It is a comprehensive blueprint of action to be taken globally, nationally and locally by organisations of the UN, governments and major groups in every area in which humans impact on the environment. The number 21 refers to the 21st century.

- The Tribal Bill proposed in 2005 suggested each forest dwelling nuclear family of Scheduled Tribes be given land up to 2.5 ha. It aimed to reverse tribal alienation caused by past policies and laws. It was shelved after altercation between environmentalist and government. Environmentalists feared that access to the forests would harm India's wildlife in the face of dwindling tiger populations.

GREEN MOVEMENTS

- It has been a part of our culture to worship the components of the environment - sun, water, trees and animals. *Vedic* scriptures of the Hinduism refer to the sun as the storehouse of inexhaustible power and radiance. Also, many rivers e.g. Ganges are considered sacred. The Pipal, Banyan, Goolar, Amla, Vilva, Sandal, Neem, Mango, and Babool are the trees that are worshipped in India. Animals like Tiger, Lion, and Cow have been worshipped since ages.

Bhimashankar

- Conservation ethos and traditions are so deep that divinity status is given to almost all forms of life. "Sacred groves" (patches of forest dedicated to local deities) are unique and distributed all over India. There are about 17,000 known sacred groves in different phyto-geographical regions and forest types of India.
- Maharashtra has about 250 sacred groves, known as *devrais*, in the districts of Pune, Ratnagiri, Raigad, and Kolhapur with a large variety of rare species and great biodiversity. e.g. Bhimashankar.
- The Bishnoi sect is a community of nature worshippers founded by Guru Jambheshwarji. Felling of trees and hunting of animals is considered sacrilegious.
- Guru Jambheshwarji had laid down 29 principles to be followed by the sect. Bish means 20 and noi means 9; thus, *Bishnoi* translates as *Twenty-niners*.
- In 1737, members of the Bishnoi tribe opposed the state to prevent felling of trees in Khejerli village, Rajasthan. When the King of Jodhpur ordered trees to be cut, the Bishnois were indignant, and sacrificed their lives to save the trees.

Bishnoi tribe

- Bishnoi settlements are like oasis in Thar, the desert area of Rajasthan with green-belts, birds, black bucks and *chinkaras* which roam about fearlessly.
- They also have a sizeable presence in the neighbouring states of Gujarat, Haryana, Punjab and Delhi. The Bishnoi community observes religious gatherings known as Melas twice a year at Mukam, since the 16th century.
- The recent resentment of Bishnois over killing of blackbucks by a film actor and his fun-loving party could be appreciated against this background.

- The Chipko movement created history when villagers hugged their trees to prevent them being felled. The first Chipko action took place spontaneously in April 1973 and over the next five years spread to many districts of the Himalaya in Uttar Pradesh.
- The name of the movement comes from a word meaning 'embrace': the villagers hug the trees, saving them byinterposing their bodies between them and the contractors' axes.
- Sunderlal Bahuguna and his supporters in the Himalayan villages started this movement. One of Chipko's most salient features was the mass participation of women villagers.
- As the backbone of Uttarakhand's agrarian economy, women were most directly affected by environmental degradation and deforestation, and thus connected the issues most easily.
- "The solutions of present-day problems lie in the re-establishment of a harmonious relationship between man and nature. To keep this relationship permanent we will have to digest the definition of real development: development is synonymous with culture. When we sublimate nature in a way that we achieve peace, happiness, prosperity and, ultimately, fulfillment along with satisfying our basic needs, we march towards culture." Sunderlal Bahuguna.

Advanced Locality Management

- Advance Locality Management (ALM) as the name suggests is a concept to manage the locality and its surroundings.
- Firstly, the garbage and filth of the area is segregated and removed with the active participation of local authorities and citizens. After which various projects such as vermiculture, tree plantation drive and other beautification projects are undertaken.

➨ First implemented at Joshi Lane, Ghatkopar, 1997; the idea behind it is promotion of partnership between the citizens and the municipal corporation.

- NISARGRUNA plant developed at Bhabha Atomic Research Centre for disposal of solid biodegradable residues tries to pay back Nature's loan in the form, which Nature wants.

➨ This indigenous technology was developed to convert municipal organic solid waste into biogas and manure and can be deployed for waste management and for livelihood creation amongst the poor.

➨ Unlike conventional single-phase digesters, which take 30-40 days, a 'Nisargruna' plant can digest organic solid waste between 18-22 days thereby saving in plant area and capital costs.

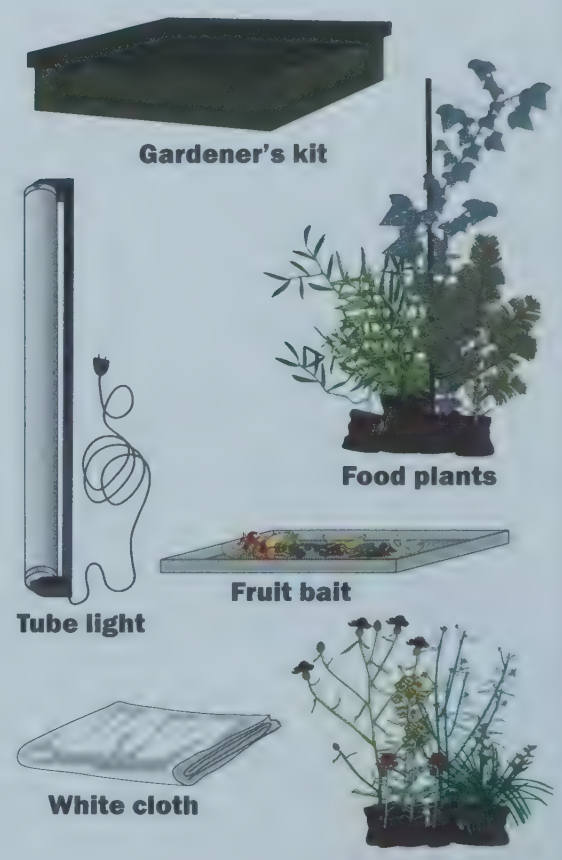
➨ About 20 plants are set up using this technology in and around Mumbai in association with the urban local bodies and NGOs. Two successful ones being at BARC, Anushaktinagar.

Green Projects

This section deals with hands-on-activities you can carry out with your students. These are interesting project topics too.

STUDYING INSECTS AROUND YOU

Activity 1: How to develop a butterfly garden?



Objectives: Students will learn

- About the plants and insects and their relationship.
- Food plants and nectar plants of butterflies.
- Different stages in the life cycle of butterflies.
- To identify the different species of butterflies.
- To develop sensitivity towards nature.

Background: Knowledge about plant-animal associations in nature

Subject: Science

Approach: Observation and research

Material Required: Gardener's Kit, food plants and nectar plants of butterflies, butterfly field guide.

Method:

1. Ask the students to plant food plants and nectar plants in different plots of the gardening area.
2. Ensure that the plot is sunny and within the school compound or if sufficient space is not available, even pots could be used.
3. When plants have grown sufficiently, the class may be divided into groups of five and each group will become caretaker of the garden for a week.
4. Ask students to keep a watch for visiting butterflies in the garden and report it.

Name of nectar plants: Lantana, Cockscomb, Common Chaste tree, Marigold, Cosmos, Periwinkle, Poinsettia and Mexican Sunflower.

Name of food plants	Name of Butterfly that lays eggs on them
Lemon tree, Curry leaves	Common Mormon & Lime butterfly
Giant Milkweed	Plain Tiger & Common Crow
Bryophyllum	Red Pierrot
Portulaca	Danaid Eggfly & Great Eggfly
Ginger Lilies	Grass demon
Bitter Hedge	Common Silverline
Ixora	Monkey puzzle
Mussaenda	Commander

Activity 2: Butterfly Baiting

Objectives: Students will learn
- To identify the different species of butterflies.
- About feeding habits and diet of butterflies.
- To develop sensitivity towards nature.

Background: Knowledge about butterfly food

Subject: Science

Approach: Observation and research

Material Required: Over-ripe fruits like banana, guava, papaya, jaggery or sugar or sugar syrup, 1 can of beer, water, pen or pencil, notebook, butterfly field guide.

Butterflies Attracting to Fruit Bait

Method:
1. Mix the chopped fruits, jaggery, beer and water to make a slurry.
2. Leave the paste overnight and allow to it to ferment.
3. The next day, divide the students into groups of 5 to 8 and give each group the slurry in a shallow dish.
4. Ask each group to leave the slurry outdoors in the open sunny area.
5. The slurry will begin to attract butterflies, who are attracted to it for the minerals it requires in its diet.
6. Let the students observe the different types of butterflies: their shape, colour, wing patterns and the way they fly. Each one is unique in its own way.
7. Ask students to note down their observations and make rough sketches.
8. Use a butterfly field guide or the help of an expert to identify the new fluttery friends!

Activity 3: Light Trap for Insects

Objectives: Students will learn
- To identify the different species of moths and other insects.
- To differentiate between moths and butterflies.
- To develop sensitivity towards nature.

Background: Knowledge about moths in general and types of moths found in the area.

Subject: Science

Approach: Observation and research

Insect Light Trap

Material Required: Tube light, white sheet, stand or rope to hang the sheet, pen or pencil, notebook.

Method:
1. Wait for a new moon night to set up your light trap, as it is the darkest night that will attract the most number of insects.
2. Set up the white sheet like a screen.
3. Place the tube light next to the sheet and switch it on.
4. All different kinds of moths and other insects will get attracted to the light and settle on the sheet.
5. The insects will sit comfortably on the sheet for a long time, giving the students perfect opportunity to study them in detail.
6. Ask the students to note the different types of insects, their colour, size and other unique features.
7. They may also make a sketch of them.
8. Refer to an insect book or ask an expert to identify the insects.

Activity 4: Rearing Caterpillars

Objectives: Students will learn
- To identify the different species of butterflies.
- About food plants of butterflies and moths.
- Different stages in the life cycle of the butterfly/moth.
- To develop sensitivity towards nature.

Background: Knowledge about the life cycle of a butterfly/moth and comparison with life-cycles of other insects.

Subject: Science

Approach: Observation and research

Material Required: Plastic Jar (with holes made in the lid), food plant of the caterpillar, data sheet, pen or pencil.

Butterfly Rearing Box

Method:
1. Ask the students to locate and collect a caterpillar on any garden plant.
2. Then let them take a clean, wide-mouthed plastic jar (double the size of a jam jar) and make some holes in the lid, which will allow air to enter into the jar.
3. Ask them to place the caterpillar inside the jar with a few leaves of its food plant. They should feed the caterpillar every day with fresh leaves and take efforts to clean the jar every day.
4. Within a few days, they will find their caterpillar growing big and a day will come when it will stop feeding and start wandering restlessly. They may also observe a change in the body colour and this is the time when they should provide some dry stems or twigs, which will be used by the caterpillar for pupation.
5. Soon they will find a pupa attached to the twig, within which the caterpillar's body is shaping up into a butterfly.
6. Within a week, they can see the pupa getting darker and the glimpses of future butterfly begin to show. They may be thrilled and surprised to see one morning, a beautiful butterfly inside their jar.
7. Ask them to release their butterfly and enjoy the moment when it takes off into the air. They can record their findings in the format given ahead.

Life History Data Sheet

Name of the Butterfly/Moth	Common Name: Latin Name:
Name of the food plant on which the caterpillar/egg was collected	Common Name: Latin Name:
Type of the food plant (Tick off the correct option)	Tree/Shrub/Herb/Climber Evergreen/Deciduous/seasonal
Description and size of the Egg/Caterpillar (from the day of collection till the day of pupation)	
No. of feeding days of the caterpillar	
Did the caterpillar moult?	Yes/No. If yes, then how many times? Was the moult eaten? Yes/No
Elaborate on the feeding habits of the caterpillar	
Did you notice any defense mechanisms in the caterpillar?	
Description and size of Pupa/Cocoon	
Place of pupation	
No. of days spent in pupation	
Time of emergence of butterfly/moth	
Did the caterpillar or pupa survive till the last stage?	Yes/No If No, what are the reasons? Please elaborate
Description and size of the adult that emerged	
Any photographs or illustrations, please attach to the report	Yes/No
Any other observations	

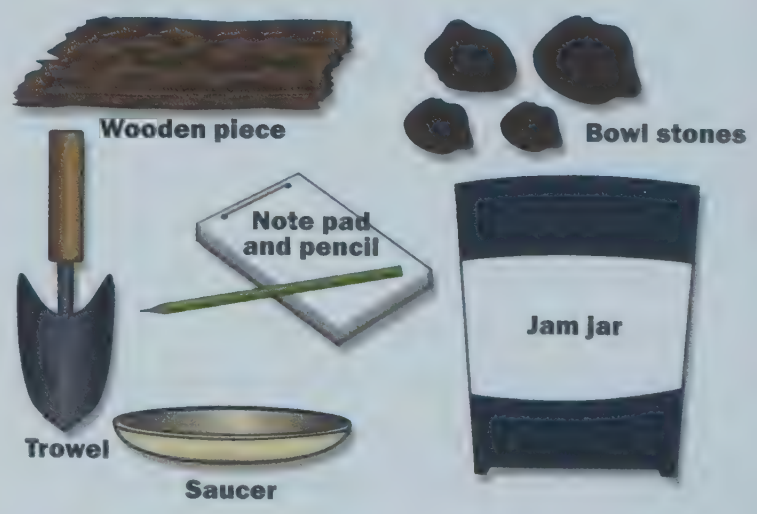
Activity 5: Studying ground dwelling insects

Objectives: Students will learn
- To identify ground dwelling insects.
- To learn about their adaptations.
- To understand the importance of leaf litter on ground.

Background: Knowledge about common insects and the importance of these in the web of life.

Subject: Science

Approach: Observation and research

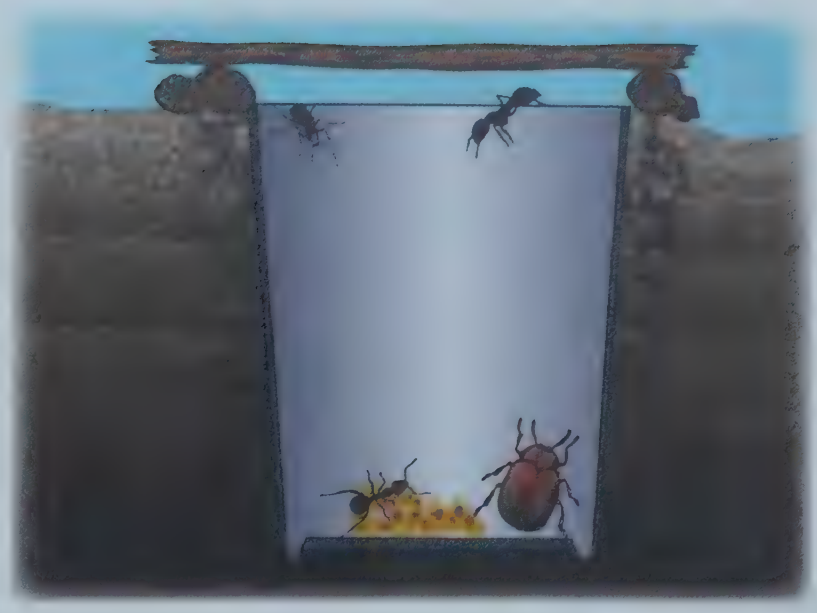


Material Required: Trowel, dish, saucer, nature diary, four stones, piece of wood or a tile, plastic jar.

Method:

1. Ask the students to dig a hole in the school garden and sink their plastic jar into it, so that

its rim is level with the soil.



2. Let them fill in soil around the edges of the jar and drop a small piece of cheese or other bait into their jar trap. The smell of the bait will attract insects to the trap.
3. Ask them to put the four stones around the top of the jar and lay the piece of wood across them to make a protective cover for the trap. The cover of the trap protects the insects inside it from bright sun, the rain or any hungry animals on the prowl.
4. Let them empty the insects in the trap onto a dish everyday and observe them.
5. Ask the students to write down what they have caught in their nature diary, and then set the insects free.
6. Let them try setting several traps, using different baits, such as meat, fish or fruit. Different types of bait attract different insects. To see which insects live where, sink traps in different places: in a flowerbed or vegetable plot.

BIRD WATCHING

Objectives: Students will learn

- To identify the different species of birds.
- About adaptations of beak and feet in birds.

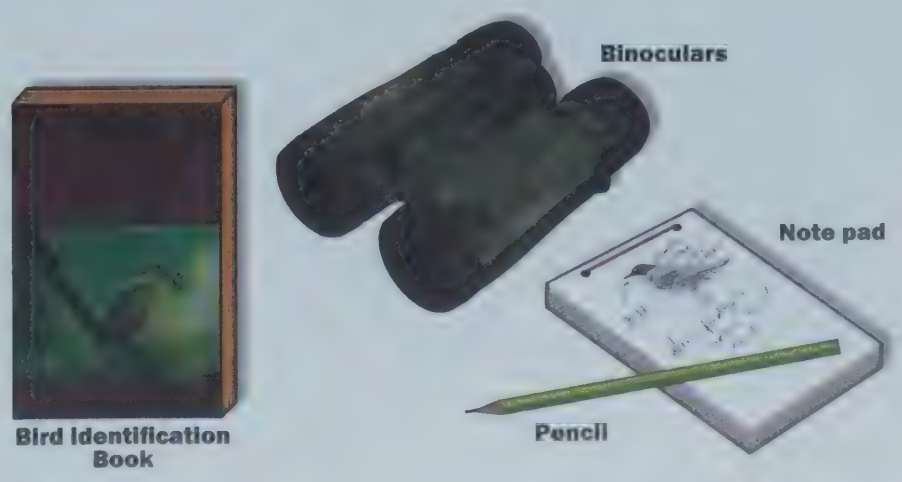
Background: Knowledge about the diets of various birds and how their beaks and feet are adapted to these diets.

Subject: Science

Approach: Field study

Material Required: Binoculars, bird field guide, pen or pencil

Method:



1. Select a place for bird watching.
2. Divide the students into groups of five.
3. Provide each group with the data sheet and ask them to fill in their observations in the data sheet.
4. Ask students to use binoculars to observe a bird and use field guide to identify the bird.
5. After collecting the data, discuss the different types of beak and feet in relation to the diet and the habitat of the birds.

Use following data sheet for data collection:

Sr. No.	Parameters	Observation
1	Size	The foremost important thing is to write down the size of the bird. The bird could be the size of a sparrow, myna, crow or eagle. If the bird is slightly bigger than a sparrow write sparrow (+) and if less than, write sparrow (-).
2	Shape	Look at the shape of a bird. It may be slender or plump, it may be long-necked or long-tailed, or with long or short legs. These are important features in identifying a bird.
3	Colour	Usually one colour is dominant in a bird. Note this dominant colour found on different parts of the bird. Remember that in many birds, males and females have different colours and that the young-ones may look different. Some birds may even have different colours at different times of the year.
4	Beak	There are different shapes of beaks depending on the food they eat. Note the shape, size and colour of the beak.
5	Location	Make a note where you saw the bird e.g. on a tree, in water, on land, in bushes and so on.
6	Migratory Birds	Some birds are seen only during a particular season. They migrate from far off places, even from other continents. They can be seen only in particular months. Write the date and month when you see such birds.
7	Identification of Birds	After collecting the above data, please refer to books on birds for identifying the bird. BNHS publication's Dr. Sálim Ali's Book of Indian Birds is the best book, which any beginner can refer to. A coloured plate with brief information is just ideal for any beginner or expert.

Give following important instructions to your students for bird watching:

- If they sight a bird, then they should be quiet and talk softly as little as possible and should observe carefully as much as they can. If they want to go closer to a bird, they should do so gradually and not abruptly. They should pretend as if, they are not interested in it and approach casually.

- They should observe the bird carefully and note down their observations immediately or they may forget important aspects by the time they reach home.
- If they are not certain of any aspect in description, then they should not record it.
- Birds are very active early in the morning; hence, it is the best time bird watching.
- They should always remember that a bird is more important than the bird watching. They should not throw stones and make the bird fly just to have a good look and should never disturb a bird on the nest.
- They should avoid sudden movements as this may disturb birds.
- They should be prepared to stop frequently to watch and listen. Spending half an hour sitting in one spot can be very fruitful.
- They should not step on fallen dried leaves and twigs, the sound of which is often disturbing to birds.
- They should always carry binoculars it's an important tool for a birdwatcher. They should consult a birdwatcher before buying a pair of binoculars. Most birdwatchers prefer a magnification of between 7 and 8. All binoculars are marked with figures like 8 x 40, which means that magnification is 8 times and diameter of the object lens is 40 mm. Ideal combination is 8 x 40.
- Lastly, for good bird watching, silence, patience and persistence is required.

STUDYING TREES

Activity 1: Know trees around you

Objectives: Students will learn
- To identify and describe the parts of a tree.
- Differences between deciduous and evergreen trees.
- To create a dichotomous key to distinguish characteristics of evergreens and deciduous trees.

Background: Knowledge about trees in general and their types.

Subject: Science

Approach: Field study

Material Required: Data sheet, pen or pencil, tree field guide.

Method:
1. Select a green area for your student activity.
2. Ask each student to make observations of one tree and note them down.
3. Prepare a data sheet (guidelines given ahead) for the students to fill up.
4. Let the students discuss and compare the data sheets.

Data sheet for Trees:

Tick the correct option

1	Name of the tree	Common/Local Name, Botanical Name
2	Location	Forest/farm, near stream/pond, or barren patches, high hills, slopes, ridges, urban and others
3	Type of soil	Black/red and others
4	Nature of the tree	Evergreen/semi-evergreen/deciduous
5	Texture of bark	Rough/smooth/cracks-vertical or horizontal or both/flakes/ knobs/others
6	Arrangement of leaves	Alternate/Opposite/Whorled
7	Type of leaves	Simple/Compound
8	Texture of leaves	Rough/Smooth/Waxy/Velvety
9	Shape of leaves	Narrow/Broad/heart- shaped/Oval/Oblong
10	Size of leaves	Measure length and breadth
11	Arrangement of flowers	Single/clusters/others
12	Flowers	Describe flowers-size, colour, shape, smell, number of petals, stamen, stigma
13	Fruits	Describe fruit size, colour, shape, seeds and methods of dispersal if possible.
14	Economic use	Edible/medicinal/fuel/any other uses.
15	Life found around it	a. Plants b. Animals

Activity 2: Taking bark and leaf imprints

Objectives: Students will learn about

- Deciduous and Evergreen trees and their differences
- The parts of a tree - roots, leaves, trunk, bark, seed (fruit)
- Use their sense of touch
- Difference between monocot leaf and a dicot leaf.

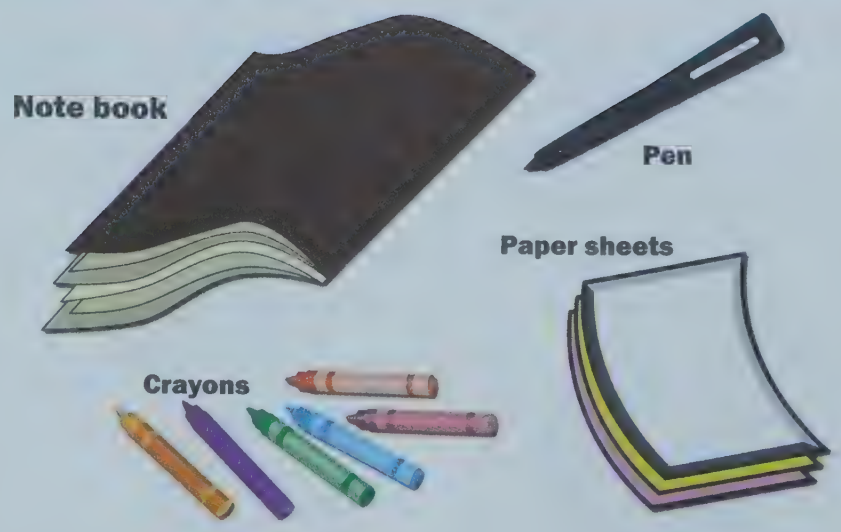
Background: Knowledge about parts of a tree and practice taking the imprint.

Subject: Science, drawing.

Approach: Drawing

Material Required: Paper, Crayon.

Method:



1. Select an area for the study.
2. Provide the students with plain paper and crayons.
3. Ask them to place a plain paper on the bark of a tree and rub it gently with the long side of a crayon (they may have to remove the paper covering of the crayon).
4. The impression of the bark texture will be imprinted on the paper. The ridges will be coloured, while the cracks in the bark will remain blank.
5. If possible, ask them to match the colour of the bark with the crayons.
6. Similarly ask them to take a leaf and place it under the paper and run the crayon back and forth over the leaf. They can use the same color of crayon as the leaf so that they can remember the leaf colour too.
7. Let them compare the patterns on the paper and discuss the type of barks and the different shapes of leaves.

Activity 3: Making a seed bank

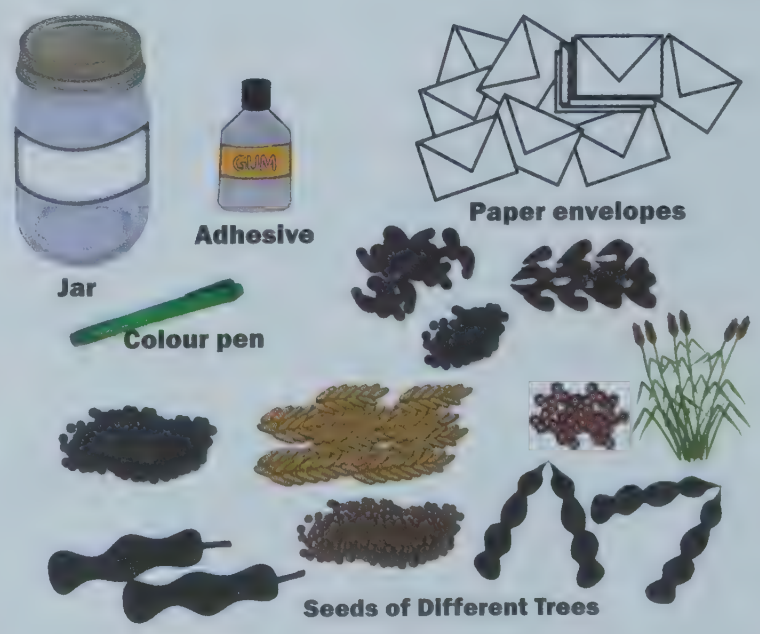
Objective: To enable students to learn about different types of seeds and to preserve these seeds for creation of a nursery.

Background: Knowledge about types of seeds and their dispersal.

Subject: Science

Approach: Observation and research

Material Required: Small paper envelopes, seeds of different trees, adhesive, colour pen, seed guide.



Method:

1. Ask the students to collect different types of seeds from wild grasses. Let them look for flower seeds once the petals have dried and a seed head has been formed. The seeds are ripe when they are brown. Cut off the seed head and shake the seeds into a paper bag. They can also collect fruit seeds, which are either in the form of pips, found in apples and oranges or have stones such as in mangoes and dates.
2. Besides fruit seeds, they can also collect all different sorts of dried beans and peas.
3. The best time to collect tree seeds is late summer, when they have just fallen from the trees.
4. Once they have collected seeds to raise a nursery, they need to preserve them until they plant them.

5. Let them sort out the seeds collected into their groups, and then take small paper envelopes, write the individual plant name on it and pour the seeds into it.
6. Ask them to keep it sealed in a dark and dry, safe place, which is pest free.
7. They can use their seed bank to set up a nursery for the school.

Activity 4: How green is your area?

Objectives: Students will learn
- To observe local environment.
- To make an effective comparison between barren and green areas.
- To understand the importance of trees.

Background: Knowledge about the important services provided by trees and information about areas with different levels of greenery.

Subject: Science

Approach: Observation

Material Required: Camera, tree guide.

Method:
1. Select an area for the study.
2. Ask the students to photograph each tree with its leaves and flowers.
3. Get the same identified by a botanist or refer a local tree field guide.
4. Let them write the respective names and count the number of photographs available with them and rate the locality as under :

No. of Trees		Assessment of the Area	Suggestions
1	Less than 5 trees	Your area needs greening	Take up tree plantation activities and make your area green.
2	Less than 10 trees	Green area, but not sufficient enough to curb the air pollution.	Do some tree plantations.
3	More than 15 trees	Ideally a green area.	Try to maintain the number and no tree cutting should be allowed.
4	More than 25 trees	Congratulations!	You are almost living in a forest

Note: Also ask them to, calculate, which is the most dominant tree in the locality. Observe which kind of life is associated with the trees (e.g. birds, insects). Ensure that for tree plantations only indigenous trees (e.g. Mango, Neem, Coral tree) are used. Do not plant any exotic trees (e.g. Eucalyptus, Australian Acacia, Copper pod) which usually do not support any life on it.

MAKING A COMPOST

Objectives: Students will learn

- To differentiate between bio-degradable and non-degradable materials.
- About biodegradation of organic matter, such as yard and food waste.
- How to convert waste into fertilizer?

Background: Knowledge about types of waste and biodegradation.

Subject: Science

Approach: Observation and research

Material Required: Shovel, vegetable waste, cow dung, dry hay, bucket.

Method:

1. Ask the students to make a pit of about 1m deep, in a secluded area in the school compound, using a shovel.
2. Then they should collect the vegetable waste from the canteen and put it inside the pit.
3. Let them put in some water, cow dung and dry hay.
4. Finally, before covering with soil, ask them to put some water over it.
5. Let it remain for two weeks.
6. After two weeks, ask the students to dig out the same pit and to observe what changes have taken place. By this time, the vegetable starts decomposing and will give out decaying smell.
7. Ask them to turn the waste over to ensure proper mixing and aeration and add some more water and cow-dung and cover the pit by filling the mud. The compost is about to get ready.
8. Within next two weeks, the organic waste thrown in the pit will turn completely into the fine wet compost.
9. Ask the students to use the manure for planting new saplings.

Note: In order to have a good compost, ensure that the waste don't contain lots of orange and lemon peels as it will make the compost too acidic, which will harm the plants. Also, do not add cat or dog faeces to the heap, which may contain harmful bacteria, which can survive the composting process and make your compost smell bad. If the heap is placed near plants, it may be necessary to add extra-nitrogen-rich elements (green leaves, vegetable, and eggshells). Microorganisms pull nitrogen from the surrounding area to help breakdown the compost waste, and this may leave any nearby plants starved of nitrogen. Adding extra nitrogen to the heap means the microorganisms won't need to plunder the surrounding soil.

Trans-section of a Compost Pit

STUDYING MARINE LIFE ON THE SEASHORE

Objectives: Students will learn

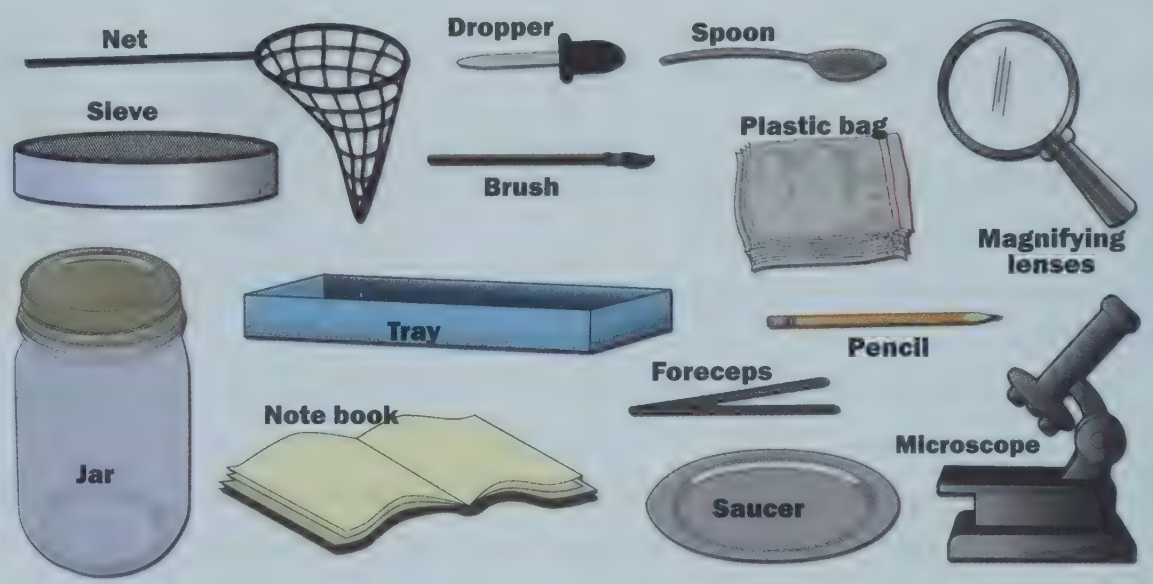
- To study about the variety of plant and animal life found in a marine habitat.
- To explore the many adaptations marine animals and plants have to help them breathe, move, feed and evade enemies in their watery world.
- To learn about basic ecology; that animals and plants are connected by energy flow in food chains and webs.

Background: A basic knowledge of marine life and food chains.

Subject: Science

Approach: Observation and research

Material Required: Net, ink dropper, spoon, brush, sieve, plastic bag, pencil, magnifying glass, tray, microscope, note book, jar, forceps, saucer.



Method:

1. Visit a sea shore with the students and ask them to observe the area.
2. Ask the students to carry a field guide and note pad. A pencil will not smudge and can be used to take down notes and drawings.
3. Magnifiers will enable them to identify small water animals. A 10X lens would be prefect.
4. Screw-top glass jars will be useful for temporary storage and examination. Do not leave animals and plants in them for long.
5. Dishes and droppers will allow them to gently remove small living things without too much of disturbance.
6. Spoon and brush will enable them to transfer small, delicate plants and animals for study and then replace them without harm.
7. Nets with different mesh sizes, for large or small specimens. Exercise caution, so as not to uproot plants. After sorting, replace the net's contents in the water as quickly as possible.
8. White enamel pans are useful for sorting through debris caught in the hand net. A little of the debris is put into a pan half filled with water. The live animals are soon seen moving about over the white bottom. Forceps are the most practical instruments for transferring specimens.
9. Aquatic plants dry out quickly in air. Keep them wet during transit in plastic bags.
10. A fine-mesh sieve can be rocked gently in water to sort small animals from mud and silt.
11. Lastly, carry a microscope. A drop of water may look clear, but under a microscope, the drop of water will be teeming with tiny water plants and animals. Magnification of about 20X to 200X is most suitable.

Important information:
Students should be informed that no two sea coasts are quite the same but by studying the telltale marks on the shore life, one can tell how high the tide rises, how low it falls, whether the area is exposed to wind and waves, or whether it is sheltered.

The journey from the edge of the land to the beginning of the sea passes through a series of bands or zones, each with characteristic animals and plants that need to be covered by the sea for different lengths of time. They should note that the highest band is the splash or spray zone, which is above the high water level of the highest tides and is occasionally drenched by spray.

Ask them to observe the plants and animals that are adapted to salty conditions which live here. Lichens are found here as well as a few straying sea snails. Barnacles, the first true marine creatures, generally mark the lower limit of the splash zone.

The next band is the inter-tidal zone i.e. between the tides, which is regularly covered and uncovered by water. It extends from the barnacles down through the seaweeds to the low-tide area, where larger seaweeds begin to take over. The third broad band is the sub-tidal zone i.e. below the tides, stretching from the larger seaweeds' zone into the permanent shallows.

STUDYING POND LIFE

Objectives: Students will learn

- About the variety of plant and animal life found in a pond habitat.
- How and why animals are sorted or classified into groups based on their relatedness.
- The different adaptations in animals and plants which help them to breathe, move, feed and evade enemies in their watery world.
- About the lifecycles of amphibians and insects.
- About basic ecology. That animals and plants are connected by energy flow in food chains and webs

Background: Knowledge about local pond life and pond ecosystem.

Subject: Science

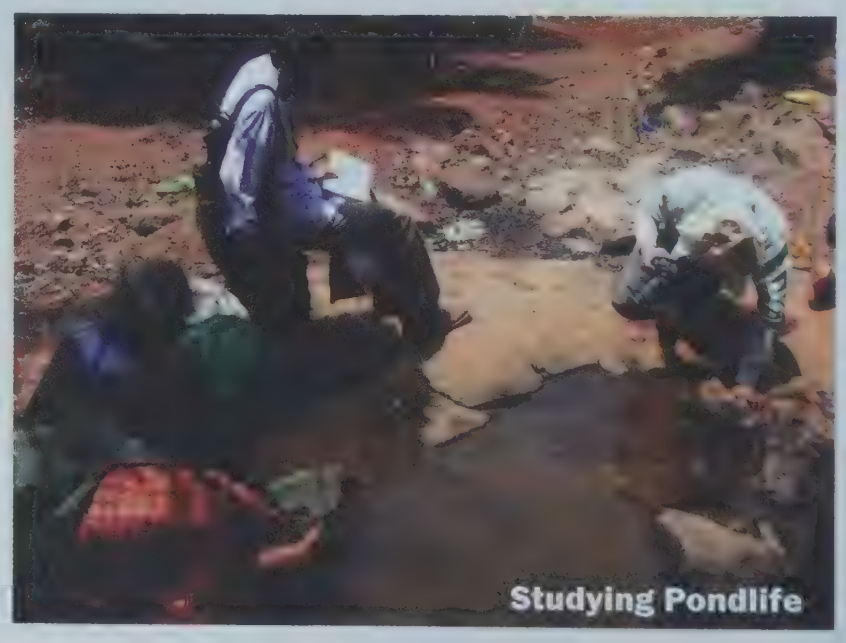
Approach: Observation and research

Material Required: Pond-dipping kit which should include fishing hand net used for fish tanks, 250 ml beaker, white enamel tray, blunt forceps, ink-dropper, magnifying glass, paper, pencil and a key for identification.

Method:

1. Select a water body that is to be studied.
2. Divide the class into groups of five and provide each group with a white tray and a net.
3. Ask the students to stand at the edge of the water body in such a way that water does not get disturbed. Let them bend and put the net inside the water until it touches the bottom.
4. Ask them to move the net inside the water from right to left once and immediately remove it out of water. The net will be filled with a number of small pebbles and stones along with the soil. Throw the stones and pebbles back in water and let them place the remaining matter on the white tray.
5. Ask them to repeat this process for two times.
6. Then let them keep the net aside, take some water, and put it in the tray which is holding the collected matter.
7. Give hem an empty, clean beaker half filled with clear water.
8. Using forceps let them separate the insects or whichever animal is seen from the tray and put them inside the beaker.
9. Once they are separate, using a magnifying glass ask them to observe the structure of the animal that is present inside the water, find out the different body parts and try to note it down on the piece of paper.
10. If possible, you can also ask them to sketch a rough drawing of the same.
11. Now let them take the identification key, which gives the details of the animal body parts and discover the name of the animal that they have found!
12. They can use a microscope to see the microscopic animals in the water.
13. Once the study is over, see to it that they do not kill the animals and release them back in to the water because that is where they belong.

Aquatic Insects



Studying Pondlife

Besides knowing the pond life, they can also study how polluted the water is. The reference table below gives the degree of pollution present in the water in relation to the animals found in it.

Name of animals	Level of pollution
Mayfly larva, stonefly larva	No pollution
Caddisfly larva, freshwater shrimp	Slight pollution
Water louse, bloodworm	Medium pollution
Sludge worm, rat-tailed maggot	High pollution
No life found	Very High pollution

PAINTING EGGSHELLS

Objectives: Students will learn

- To teach students that recycling can be fun.
- To instill a love for animals and nature.
- To develop creativity in the students.

Background: Creative ideas and practice painting the eggshell.

Subject: Arts

Approach: Creative and Artistic

Material Required: Empty egg shells, pencil, sketch-pens, brush, varnish, picture of animals or birds, small piece of card board paper (5 x 5cm), adhesive agent.

Method:

1. While using eggs, ask the students to break only the lower portion and keep the remaining eggshell (vertical, oval portion) intact.
2. Ask the students to wash the egg thoroughly and dry it in the sun.
3. Then let them draw the picture of any animal, bird, insect, fish, amphibian or reptile that they want to paint on the eggshell with a pencil.
4. Take care that they do not exert pressure on the egg shell lest it breaks.
5. Once the sketching is over, ask them to colour the picture with sketch pens and coat it with a light brush of varnish (to give it a fresh look and a bright sheen).
6. If they want they can write a small slogan on top; like "Save Nature", "Tigers in Wild", "Wild beauty", "Bird paradise" or make a series of nature paintings and name them as "Beautiful people!!

Painted Egg Shells

7. Ask them to take a piece of cardboard paper (5 x 5 cm) and stick the egg shell on the card board with any good adhesive.
8. The egg-painting is ready.

This can be gifted to friend, teacher, parents ... to anybody whom they like and spread the message of love and care for nature!

STUDY OF ANIMAL TRACKS

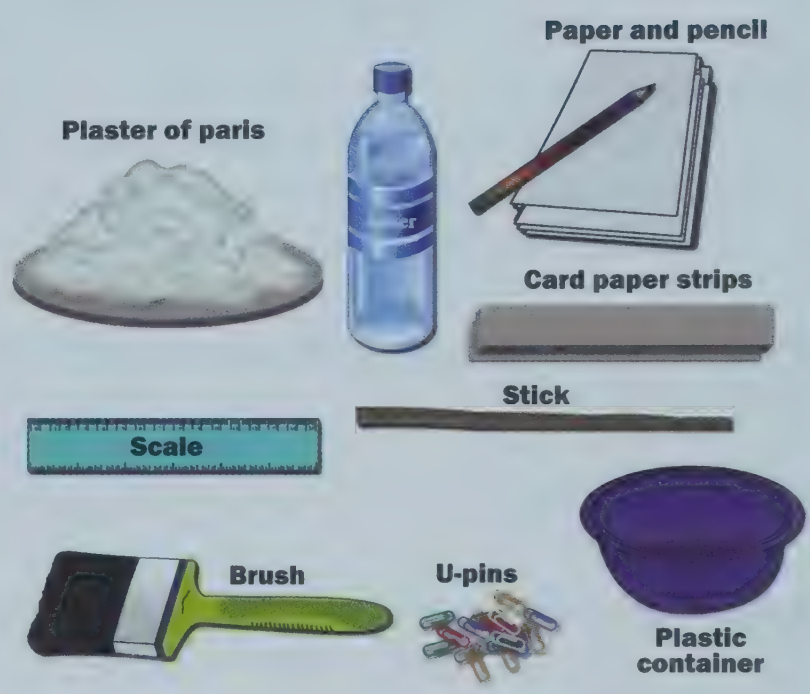
Objectives: Students will learn
- To generate an interest in nature through fun learning.
- To learn a scientific method of identifying an animal.

Background: Knowledge about the tracks of different types of animals and practice in preparing the plaster mixture properly.

Subject: Science

Approach: Creative and Observational

Material Required: Plaster of Paris (1kg), water, small container, stick to stir, strips of card board (5 x 15 cm), paint brush, U-pins, scale, pencil, paper.



Method:
1. Divide the students into groups of five.
2. Ask them to find a fresh foot print which is not much disturbed such as that of a dog or cat paw, cattle hoof or bird feet (they can also make their own print).
3. Let them clear the soil around the footprint.
4. Now ask them to take one cardboard strip, make it into a circle, fix its ends by u-pins and keep the cardboard frame around the footprint/ pug-mark.
5. Now take 20 spoons full of Plaster of Paris in the container. Slowly add half glass of water. After adding, stir and see the consistency of the liquid. Take care that it should be as thick as a slurry.
6. Once the slurry is ready, do not waste time as the Plaster of Paris dries up very soon.
7. Ask them to pour the slurry inside the frame from one corner and let the slurry cover the frame fully.
8. See to it that the slurry spreads evenly inside the frame covering the footprint. Wait until it dries completely. It should take a maximum 35-40 minutes after pouring (ideally leave it to dry overnight).
9. Once it is dry, ask them to remove the frame first, by unlocking the free ends by removing pins. Then pierce a stick from upper surface to see whether it is dried from inside. If it does not go inside that means, it is dry and ready to be removed.

10. The plaster cast is now ready. Let them lift up the whole cast and turn it over. Ask them to remove the dirt with the help of a dry brush and measure the length and breadth of the footprint with the help of scale and try to sketch it on paper.

Visit different national parks or sanctuaries with your students and after seeking appropriate permissions, they can try to take plaster casts of different animal tracks that they come across. Ask them to collect such tracks and find out other details about the animal to make a wildlife diary for their record.

MAKING HANDMADE PAPER

Objective: Students will learn

- A simple way of recycling paper.
- To turn waste paper into innovative artifacts.
- To understand the importance of saving paper and recycling waste.

Background: Knowledge of how paper is made (importance of trees and deforestation) and practice in making the handmade paper.

Subject: Craft

Approach: Creative and Hands-on learning

Material Required: Old newspapers, container/tub, flat vessel or tray, scissors, water, mixer, sieve, knife.

Method:

1. Divide the students into groups of five.
2. Collect some newspapers and ask the students to cut them into small pieces with the help of scissors.
3. Take a tub and fill it with plain water. Ask them to soak the pieces of paper in the tub filled with water. Allow them to soak completely for three days.
4. After three days, take a mixer and put the soaked paper into the mixer to be blend into a fine paper pulp.
5. Once your paper pulp is ready, it can be used to make paper of various thickness.
6. Now divide the students into group of five and distribute the pulp to group.
7. Now ask each group to take a flat tray and take four tablespoons of paper pulp, add one glass full of water to dilute the pulp.
8. Give them a sieve and ask them to hold it with both hands, place it at the bottom of the tub,

and remove it in such a way that the dilute pulp is spread all over the sieve.

9. Let the water drip down from the sieve and only the pulp remain on the upper side.
10. Ask them to keep this sieve in a sunny place and let it dry. It takes four to five hours for paper to dry completely.
11. Once the paper has dried, ask them to take a knife and run the pointed end from the sides of the sieve. Then slowly separate the paper and sieve.
12. That's it, their handmade recycled paper is ready
13. The paper that they get will be grey in colour. To make coloured paper, they can add few drops of poster colour. They can also make paper with different patterns by using oil colours. They can even add dried flowers or leaves to the pulp!

MAKING BADGES AND SLOGANS

Objectives: Students will learn

- To spread awareness.
- To encourage students to be environmentally active in their community.
- To learn about the latest environmental issues.

Background: Knowledge about recent environmental issues.

Subject: Drawing and Language

Approach: Research and Creativity

Material Required: Card paper, old greeting cards, pencil, colour crayons or sketch pens, safety pins.

Method:

1. Give each student a small piece of recycled paper (5 x 5 cm).
2. Ask them to decide a picture and the message that they would like to convey to their friends and others.
3. Tell them to write the short messages (not more than 12 words) on a rough paper separately.
4. Now they can start drawing the picture, and then colour it. Ensure that their drawing and message are bold enough to be seen and understood from a distance.
5. Once the drawing and colouring work is over, ask them to fit the slogan on the badge where it can attract attention.
6. They can now pin it up on their dress to carry it wherever they go and convey a "Green Message" to everyone!

MAKING A POSTER ON CONSERVATION

Objectives: Students will learn

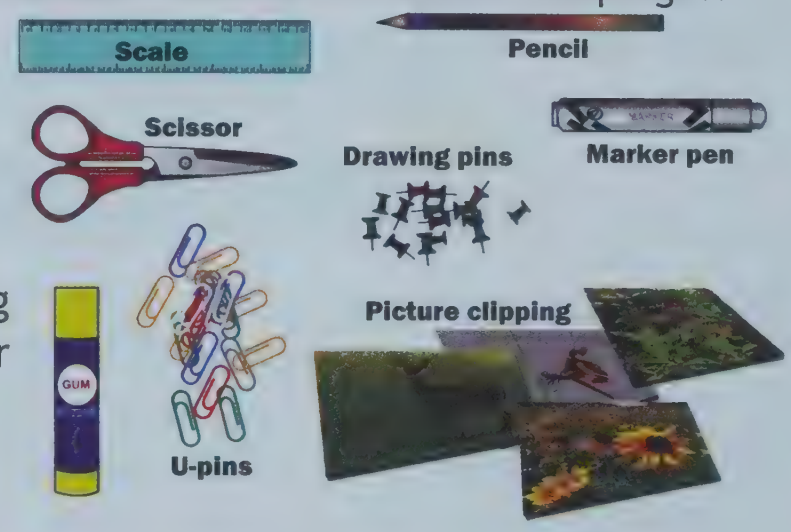
- To spread awareness about wildlife and conservation.
- To learn about environmental and conservation issues.
- To learn a method of environmental advocacy.
- To develop a bond with nature, to promote care and understanding.

Background: Knowledge about the latest environmental issues and conservation campaigns.

Subject: Drawing

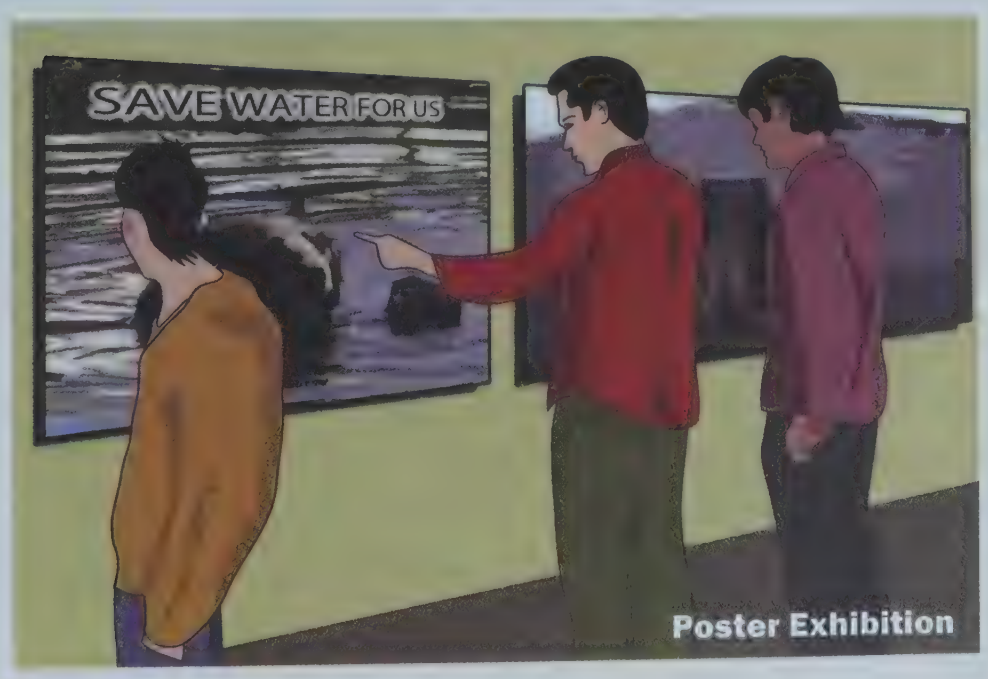
Approach: Research and Information dissemination.

Material Required: Scissors, glue, ruler, pencil, drawing pins, colourful picture clippings from magazines or newspaper and marker pen.



Method:

1. Divide the students into groups of five and give each group a poster paper.
2. Ask the students to first think about the place where they are going to display their material and then ask for the necessary permissions.
3. They should first make a rough diagram of the area and take its measurements.
4. Next they should try to find all the pictures they need to make the display; old wildlife magazines such as Hornbill, Sanctuary, Cub or National Geographic are useful resources.
5. Also, ask them to work out what they would like to say. They should think of a catchy slogan or title for the display. If it is to be attractive, they will need captions for the pictures they are displaying - these must be kept short.
6. They can then paste the pictures onto the card. This will look good and will help the display last a long time.
7. Finally, they can put up their display with the help of pins! Drawing pins are best, but check with the owner or manager of the place as how best to put up the display.



Here are some frequently occurring problems with solutions during the display:

Problem 1: People will only stop to look and read a display if it is attractive.
Solution: To make it striking ask the students to use pretty pictures, big lettering or other eye-catching ideas.

Problem 2: People may stop and look but not read or take in the message.
Solution: Inform the students not to use too much of text. Just a few pictures and very short but sharp message will do. If they want more information put captions beside the pictures, which inform people about the problems wildlife is facing. If people want to read captions but if not, the title or slogan should give them an idea.

Problem 3: People may stop to look and read but have you left them with all the information they need to know?
Solution: Ask the students to make a feedback form wherein people visiting their display will express their views. If they feel strongly about the message then something constructive can be done about it.

STUDYING AIR POLLUTION

Objectives: Students will learn
- To learn about pollution and its effect on the environment.
- To study air pollution along with its causes and effects.
- To be aware of how mankind pollutes the Earth.
- To be aware of ways in which we can help reduce air pollution.

Background: Knowledge about air pollution including its definition, causes, effects and methods to curb it.

Subject: Science

Approach: Observation and research

Material Required: Two sided tape, microscope.

Method:
1. Divide the students into groups of five.
2. Make each group responsible for one windowsill in the classroom.
3. Ask each group to clean their windowsill before the start of the experiment.
4. Next ask the groups to attach a piece of paper to a surface outside and observe it over a period of time.
5. They should also place some two-sided tape outside for a period of time.
6. After sometime (you may ask each group to do it for different periods of time e.g.5 minutes, 1 hour, 1 day, 1 week or more) take down the paper and the tape.
7. The paper and tape will have some particles attached to it.
8. Ask the students to observe them closely with a hand lens or under a microscope. What shape are the particles? Are they similar in size?

9. Also ask the students to collect some leaves and look at the surface with a hand lens. They should try to remove and collect the dirt. This may be achieved by firmly attaching sticky tape to the leaf and then peeling it off. The tape may be mounted on white paper or observed under the microscope.
10. They can also go on a lichen hunt. The presence or absence of particular types of lichens gives a measure of the amount of air pollution (as shown in the table).

Type of Lichens	Level of air pollution
No lichens	Very bad air pollution
Only crusty lichens	Fairly polluted air
Leafy lichens	Slightly polluted air
Shrubby lichens	No air pollution

STUDYING NOISE POLLUTION

Objectives: Students will learn

- To learn about pollution and its effect on the environment.
- To study noise pollution along with its causes and effects.
- To be aware of ways in which we can help reduce noise pollution.

Background: Knowledge about noise pollution including its definition, causes, effects and methods to curb it.

Subject: Science

Approach: Observation and research

Material Required: A row of shrubs, portable music player, song disc, sound level meter, measuring tape.

Method:

1. First, divide the students into groups of five.
2. Next, ask them to locate a line of shrubs.
3. One group should then place the music player on one side of the shrubs and play the song disc. The volume should be very loud. Ask another group to stand on the other side of the shrubs and measure the sound by using a sound level meter.
4. They should observe the average sound level and the loud peaks in the music.
5. Ask another group to measure the distance between the group playing the music and the group with the sound level meter.
6. Next, ask the groups to place the music player at the same distance from the sound meter, but this time in a clear area where there are no shrubs or other barriers between the meter and the sound source. Note the readings and calculate the difference between two readings.
7. The difference will show that when there was a shrub barrier in between, the noise produced was less whereas, when the shrub barrier was absent, the noise levels were high.
8. The above experiment proves that by having more trees around us, noise pollution could be controlled.

STUDYING PAPER WASTAGE IN SCHOOL

Objectives: Students will learn

- To learn about the types of waste.
- To understand how waste can be a threat to the environment.
- To quantify and create awareness about our waste production.
- To encourage students to create less waste.

Background: Knowledge about types of waste, waste collection and degradation. Also, knowledge about the impact of excess waste on the environment and methods of reducing our wastage.

Subject: Science

Approach: Observation

Material Required: Data sheet, pen or pencil.

Method:

1. Divide the students into three groups, which will be estimating the paper wasted during exams.
2. The project can be started after declaration of semester results or after the last unit test papers.
3. Ask the students to collect the answer papers of each subject from three different standards say 5^{th}, 6^{th}, 7^{th}, or three different classes. They should find out the paper used and wasted with help of the chart given below. Pool the results of all three groups.
4. After tabulating the information, ask the students to work out the percentage ratio of paper used and wasted. Let them find out the reasons for wastage of answer papers by answering these questions:

No.	Standard	Paper used (no. of pgs)	Paper wasted (no. of pgs)	Total (no. of pgs)
1	V			
2	VI			
3	VII			

   a. Were there too many papers in one answer sheet compared to the questions asked? If yes, then the number of pages in one answer sheet should be reduced.
   b. Have students left blank pages in between answers written? If yes, students should be instructed before their exams to use the paper to the maximum extent.
   c. Did students take excess supplements they did not use? If yes, such incidents should be dealt strictly either by warning such students or by giving negative marks.

5. Once the groups are ready with all these findings, ask them to write a report on how to minimize paper wastage and share the results with other students and the principal. Maybe this project would be an eye-opener.

HOW GREEN IS YOUR SCHOOL?

Objectives: Students will learn

- To learn how environmentally aware your school is.
- To understand the ways in which our daily activities threatened the environment.
- To make the students environmentally aware and teach them how to be eco-friendly.

Background: Knowledge about resource wastage and ways to lead a more sustainable lifestyle.

Subject: Science

Approach: Observation

Material Required: Data sheet, pen or pencil.

Method:

1. Divide students into groups of five.
2. Give each group a data sheet and a pen or pencil.
3. Ask students to conduct this survey to find out how eco-friendly their school is.
4. Next to each question, they should put a tick for 'Yes' and a cross for 'No'.

No	Questions	Answers
1.	Does the school have a garden?	
2.	Is recycled paper used in classrooms?	
3.	Does the school office use recycled paper and envelopes?	
4.	Is the old paper reused?	
5.	Are solar powered calculators used?	
6.	Are lights switched off when not needed?	
7.	Are taps closed after use and opened for a slow flow?	
8.	Are leaking taps repaired immediately in the school?	
9.	Do students and teachers use cloth bags instead of plastic bags?	
10.	Is the canteen's kitchen waste and garden waste used for making vermicompost?	
11.	Does the school library provide books on environmental issues, nature or wildlife?	
12.	Does the school have a Nature Club?	
13.	Does the school have environment education as a separate subject?	
14.	Does the school celebrate the environmental days?	
15.	Does the school participate in any environmental campaigns?	

5. After completing the survey, add up their results. Every positive answer gets one point.

15 points	Congrats, yours is the no. 1 eco-friendly school.
Less than 15 and more than 10 points	Your school is struggling to reach the no.1 position. Keep it up.
Less than 10 and more than 5 points	You need to push your self a bit to be comfortably eco-friendly.
Less than 5 points	You will have to really work very hard to make your school eco-friendly.

Green Deeds

This section includes information about green living. You could inculcate these values in your students too.

When we hear the term "green living", many of us think of the outdoors - trees, mountains and lawns. In fact, green living can start indoors by choosing recycled plastic products, finding new creative uses for old items and cutting back our use of natural resources. Green living is best defined as protecting the environment by conserving and effectively using resources.

There may be several environmental problems, both local and global, but we cannot sit back and blame the governance machinery for not tackling these problems. When every car that runs on road is responsible for the ozone hole, similarly for every piece of garbage lying in the dumping sites, we are responsible in some way or the other. Instead of participating in the blame game let us do our own bit in a smaller way to make a difference to our immediate surroundings. This section is going to deal with all such green acts, which will make you, your family and near and dear ones environment friendly so that we live "greener lives", and leave less of an impact on the Earth.

BE ENERGY SMART

Some of the Earth's resources cannot be replaced. These include the minerals, coal, oil and gases found in the Earth's crust. The rich countries of the world are using up these resources so fast that before long there will be none left. Many of the resources are used to produce energy such as electricity. Fossil fuel resources are running out, so it is important to discover how to use less energy. It is also essential to find alternative ways of making energy using non-polluting sources such as sun, wind and water power.

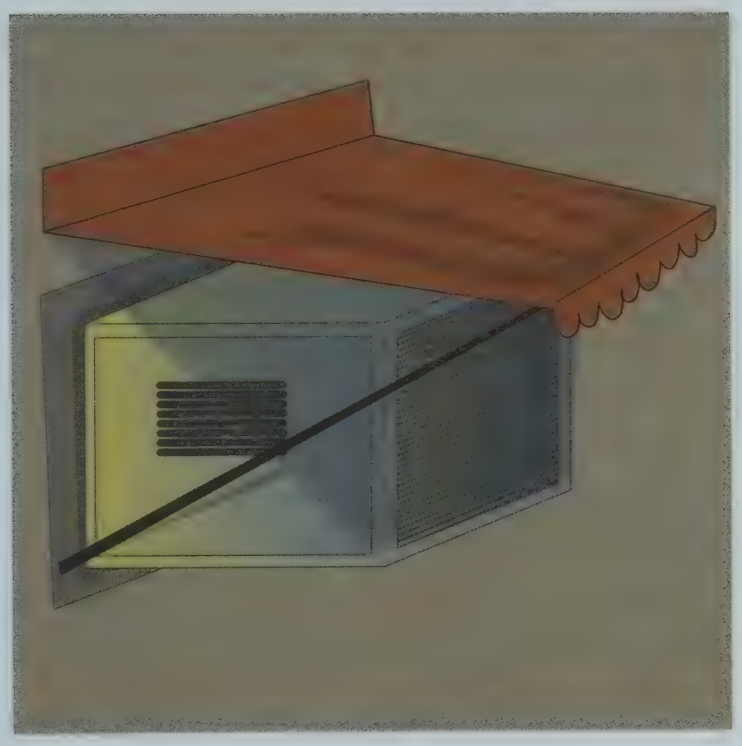
A great deal of energy is wasted. For an energy efficient future, new techniques and attitudes will be needed to cut out waste and conserve power. Energy saving houses will be needed; petrol-run cars need to be replaced by cars with engines that are more efficient. Better public transport could cut down car use, unblock roads and make air cleaner. Factories could re-use waste heat and produce goods that are energy efficient.

Much of the energy we use in our homes and factories is in the form of electrical energy. Most electrical energy is made by burning fossil fuels, although some comes from nuclear power and water-driven power. A small amount of electrical energy is also made from movement energy in the wind and tides. Since natural gas is used to generate electricity, by cutting down your electric use, you can help reduce the demand for natural gas. By reducing the demand for natural gas, we can take some of the pressure off natural gas prices, which have climbed significantly in recent years. Besides electricity, we can also conserve fuel energy. You can do all sorts of things to save energy that will consequently benefit your bank account and the environment.

Things you can do to cut down your energy consumption:

1. **Inside the living room**

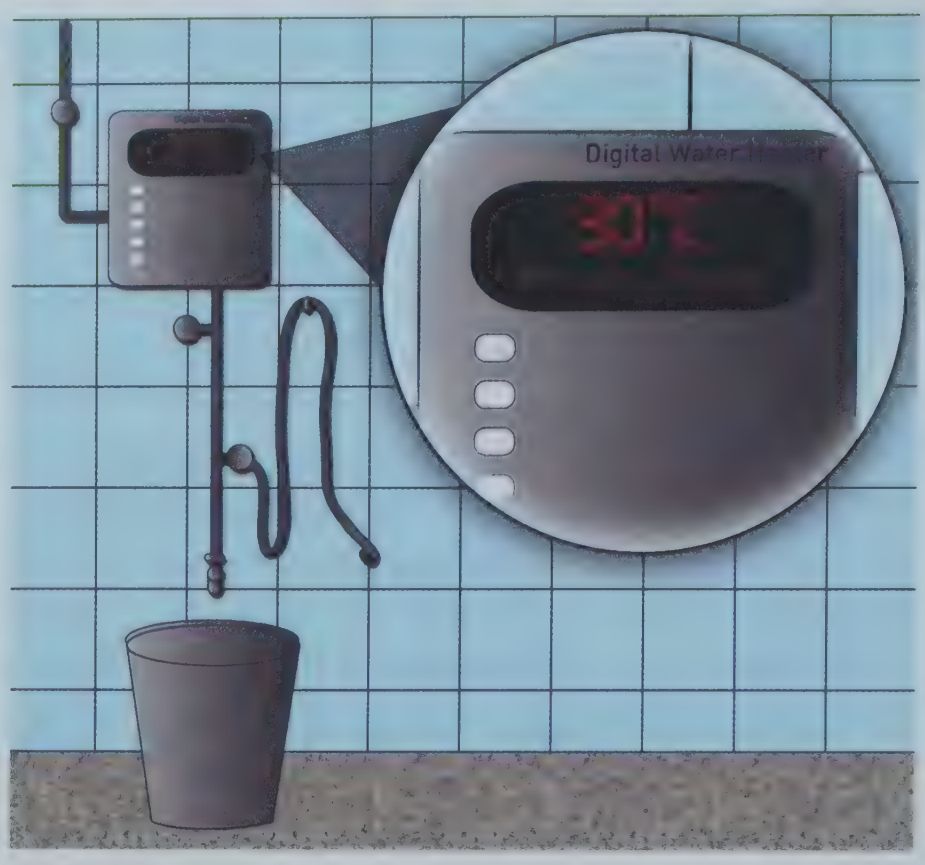
- Turn off all electrical gadgets when not in use.
- Open drapes and blinds to use free and natural daylight. Close your blinds, shades or draperies during the hottest part of the day.
- Use one higher wattage bulb instead of several with lower wattages. One 100-watt bulb produces more light and uses less power than two 60-watt bulbs.
- Install energy-efficient compact fluorescent bulbs. They give off less heat and use as much as 75 percent less energy than regular bulbs and last up to ten times as long as incandescent lights.



- A definite way to use maximum electricity with minimum pollution is to find out peak load times and reduce your use of high wattage appliances during those times. For example, it would be better to operate an air conditioner all day on a low setting and come home to a moderately cool house than to turn it off in the morning and then start it full blast in the evening when power consumption is generally high.
- Shade the outdoor air conditioning unit if possible. A unit in the sun will use up to 5 percent more energy than one in the shade.

- Consider window fans, ceiling fans or whole-house fans, which use much less power, as an alternative to air conditioners.
- When decorating, remember that lighter colors reflect light better than, darker colors and will aid in reducing the amount of light needed.
- You can reduce your power consumption a little more by not charging rechargeable items like torches and shavers continuously. Let them go for three or four days and then recharge them. Many electric shavers can go for a full week or more on a single charge.

2. Inside your bathrooms



- Set the water heater only for the highest temperature your hands will stand. Cooling hot water with cold water wastes power used to heat the water.
- Air conditioners work to remove humidity, so reserve moisture-making jobs such as dishwashing, laundry and bathing for either early morning or at night when it's cooler.

3. Inside your kitchen

- Keep your refrigerator temperature appropriate to seasonal change.
- An open refrigerator door reduces cooling efficiency and wastes power. Open as briefly and infrequently as possible.

- Leave enough space between the refrigerator and the walls. Trapped heat increases energy consumption because the air cannot circulate.
- Clean the dirty coils on the back of your refrigerator to improve efficiency by as much as 30%.
- Get rid of the old refrigerators.
- Make sure your refrigerator door is sealed. To test, close the door on a sheet of a paper and try to pull it out. If the paper slides out easily, you are wasting energy.
- Defrost refrigerators and freezers before ice buildup becomes ¼ inch thick. Frost acts as an insulator and makes your refrigerator work harder.
- Dirty furnaces, appliances, and fixtures must work harder and use more energy to do their jobs, so keep them clean.
- Use the microwave oven or toaster oven to cook small to medium sized meals. Microwave ovens use 50% less energy than conventional ones.
- Try not to open your oven door too often to check your food; each time you open it, the temperature drops 25° F.
- Remember that a blue flame means that your gas stove is operating efficiently and a yellowish flame means that it needs some adjustment.

4. Outdoors

- Landscape around your house. Trees and shrubs beautify your home, but they also help cool your home against the blazing sun in the summer and protect against harsh winds in the winter, and they improve air quality by filtering impurities.
- Use public transport.
- If you have your own vehicle then try to pool it with others.
- Avoid using your vehicle for short distances. Opt for walking or use your bicycle.

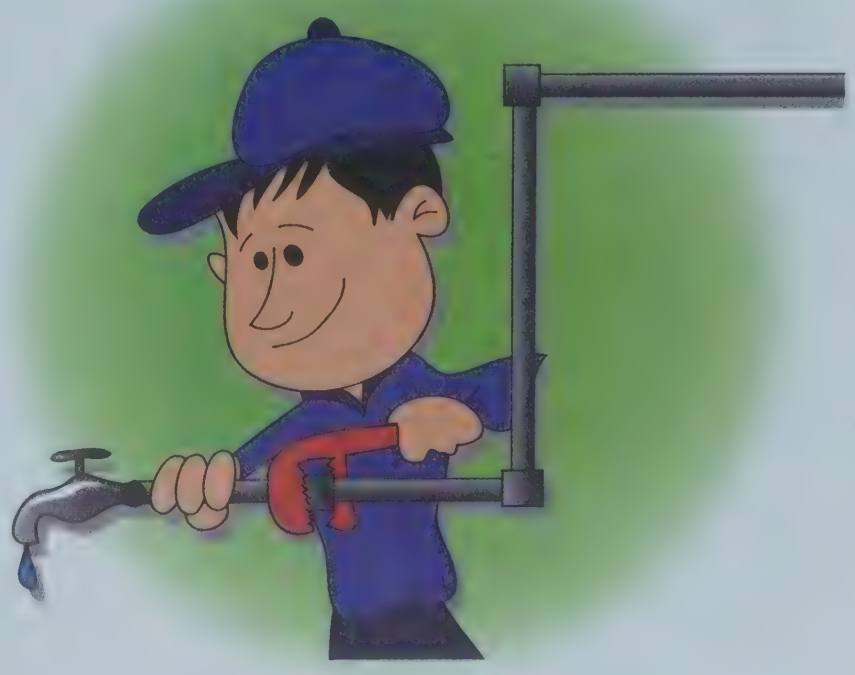
BE A WATER CONSERVATIONIST

Water is the most precious gift bestowed on us by Mother Nature. Without it, life on this planet would not have been possible. Yet we have exploited this valuable resource to such an extent that very soon even major urban cities are going to face water crises. We would be punished for taking water for granted by suffering acute water shortage. Before things go out of our control, let us do our own bit in saving this life-giving fluid.

DID YOU KNOW?

An urbanite consumes 131 litres per day for following purposes: Drinking: 6 litres, Cooking: 10 litres, Toilet (flushing): 40 litres, Laundry: 35 litres, Personal hygiene: 30 litres, and Others: 10 litres.

- Turn off tap while you brush your teeth, shave, soap or shampoo yourself, or when your clothes or utensils are being washed and keep a medium flow when you're shaving or washing dishes by hand.
- Keep taps, showers and WCs serviced.
- Fix water leaks. One drip a second adds up to about 75 gallons a month.
- Wash and/or dry full loads, but do not overload your machines.
- Use the correct amount of detergent. Too much will make your machine work harder and use more energy.



- Purchase a high-efficiency clothes washer.
- Don't use a water level higher than necessary for a load of clothes you're washing.
- Check for toilet tank leaks by adding food coloring to the tank. If the toilet is leaking, color will appear in the toilet bowl within 30 minutes. Check the toilet for worn out, corroded or bent parts. Most replacement parts are inexpensive, readily available and easily installed. (Flush as soon as test is done, since food coloring may stain tank.)
- Avoid flushing the toilet unnecessarily. Dispose of tissues, insects and other similar waste in the trash rather than the toilet.
- Opt for a bucket-bath or a shower, rather than a tub-bath. The former consumes between 16 to 40 litres of water as against 165 litres for a tub bath.
- Water plants with washings of vegetables, grains and fruits.
- Water your garden plants early in the morning or late in the evening, as watering in the afternoon leads to evapouration and dehydration of the plants.

- Fix leaking taps.
- When you need a half glass of water, fill it half only. Don't fill it up to rim and then throw the remaining part.
- Do not change water daily, as water stored does not spoil even after storage for 60 hours.

The water that is pumped to our houses is stored for months in the lakes and for 48 hours in the common storage tanks.

- Harvest rain water from roof tops and use it to mop floors, washing clothes, utensils and more.
- Do not over concretize the area surrounding your building or house, as water can then percolate naturally to the roots of plants, thus reducing the requirement of secondary watering. This also recharges the ground water table.

BE A WASTE RECYCLE EXPERT

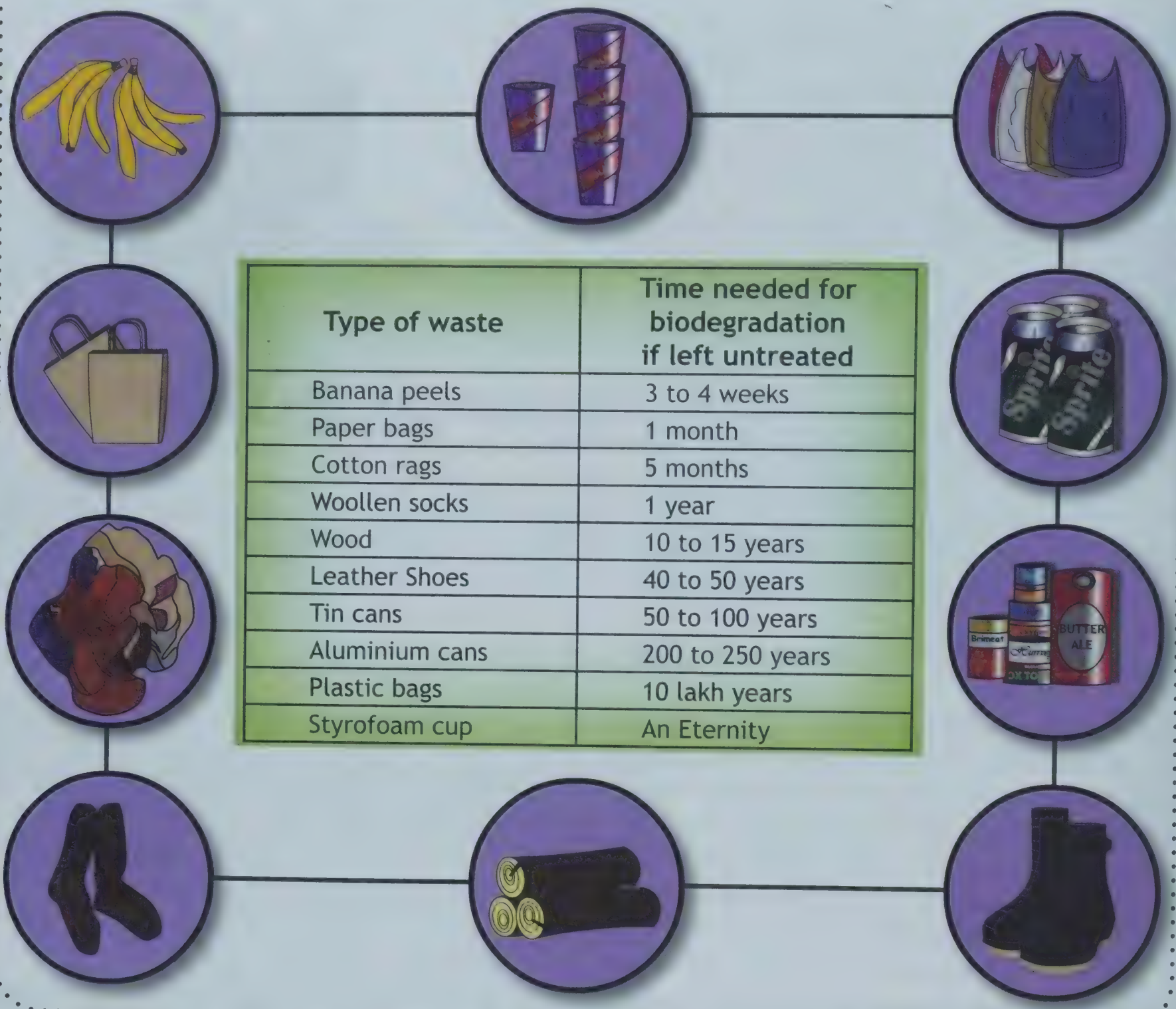
Waste is anything we no longer want, from the food scraps we throw into the dustbin to the toxic chemical effluents left over from industries. Recycling and reusing things helps to save the Earth's precious raw materials, or resources. Many of the resources used in making the things that we buy, like oil for plastic and metal for cars, are renewable. This means that the Earth has a limited supply of them. In addition, some non-renewable resources, like coal, oil and gas are used to provide the energy needed for goods and services. Today, fossil fuels are being used up so fast that they are depleting. Scientists think that if we continue to use fuels at the present rate, supplies of oil will have run out by the year 2025. Natural gas will not last much longer and coal will only last for about 300 years.

Our homes generate a variety of waste such as vegetable peels, leftover food, paper, packaging, garden wastes and others. People in the high-income bracket (Rs. 8,000/- p.m. and above) generate about 800 gm of waste per capita everyday, while those in the low-income bracket (Rs. 2,000/- p.m. and lower) generate only 200 gm of waste per day. Not only is there a variation in quantity, the nature of waste also differs.

In India, *Raddiwallas*, *Kabadiwallas*, *Kacharawallas* have been performing an excellent job of recycling most of our waste. The *Kabadiwallas* or the waste handlers, go from door to door and collect used bottles, broken plastics, metals, waste paper and others. This material is then sold for the manufacture of secondary products. In addition, the ragpickers perform an important role in recycling our waste. Although their foraging through wastes is an unhygienic practice, it still contributes to recycling efforts in India. These ragpickers act as the second filter after *Kabadiwallas* have taken away first batch of useful materials for secondary market. The income from foraging provides much needed subsistence to poorest of the urban poor.

DID YOU KNOW?

Long after you have gone, will your waste be around? Here is an account of how long it takes for a few types of waste to biodegrade:



Type of waste	Time needed for biodegradation if left untreated
Banana peels	3 to 4 weeks
Paper bags	1 month
Cotton rags	5 months
Woollen socks	1 year
Wood	10 to 15 years
Leather Shoes	40 to 50 years
Tin cans	50 to 100 years
Aluminium cans	200 to 250 years
Plastic bags	10 lakh years
Styrofoam cup	An Eternity

Recycling means putting waste back into use. This can be done by using all or some of the materials, which are used to make products. The whole idea behind recycling is that materials are kept moving in a circle of use, rather than being allowed to drop down into the waste stream. This helps reduce the amount of raw materials stripped from the Earth; it also keeps those materials out of the growing stream of solid waste. The old newspaper can be beaten into pulp and made into new paper goods such as cardboard and egg boxes. Glass jars can be melted down and made into new glassware. Waste food and plant material like orange peels can be made into compost to spread on the soil in the garden. Water bottles could be used for storage or could be cut into two and the upper half used as a funnel and the lower half as a pen stand. Almost every type of waste could be recycled.

THE MAGIC OF 3 R's

When you wonder what to do about your rubbish remember the three "R's": Reduce, Reuse and Recycle.

Try not to create so much rubbish in the first place. If you have something you no longer need, think about whether you can reuse it. If not, could it be recycled? Do not throw away anything until you are sure you cannot reuse or recycle it.

Reduce your rubbish

Waste reduction eliminates waste and prevents it from entering the waste stream. The lesser the waste, the lesser the resources needed to segregate, collect and treat waste. The manufacturing industry can help reduce waste at source by reducing the amount of packaging of their products or by designing products that have a longer life span or are easier to repair.

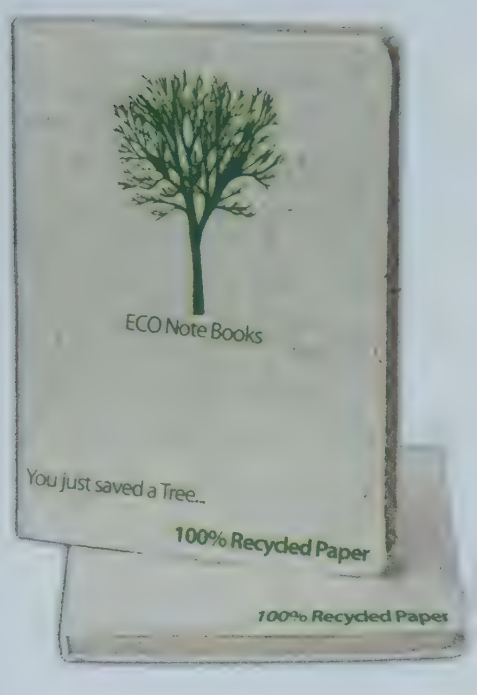
- Try to buy goods with a little wrapping as possible.
- Whenever possible, buy household items in bulk.
- Try repairing things before discarding them.
- Edit your file on the computer before printing.
- Another way to avoid instant rubbish is not to accept leaflets handed out in the street
- Take your own bag when you go shopping
- Try and avoid usage of disposable products
- Adopt paper free communication and opt for electronic transactions.

Reuse your rubbish

Reusing products requires creative application of our minds. It means using products that have outlived their lives for a purpose other than what they were intended to do. Reusing products keeps them out of the waste stream and at the same time conserves precious natural resources. Some things, like plastic containers and glass jars, can easily be used as long as they are not damaged and are made really clean. Many plastic bags can be reused and most cardboard boxes as well. Try to think of other uses for things you have finished with. You can probably come up with lots of other ideas. If you or your family has no way of reusing something, someone else may be grateful for it. Old clothes and toys could be given to charity shops or jumble sales.

- Use large soft drink bottles for keeping water in refrigerators.
- Reuse scrap paper and envelopes.
- Reuse cloth napkins, sponges and dusters by washing them.
- Wash and reuse empty glass and plastic jars as flowerpots or to store buttons or nails.
- Small children could use a large cardboard box as a playhouse.
- Plastic yogurt and cream tubs make good pots for growing seeds and small plants.

Warning: *Do not reuse containers that held motor oils or pesticides as they may be harmful.*



Recycle your rubbish

If you cannot reuse something, atleast try to recycle it. This is a resource recovery method involving separating, collecting, processing, marketing and using materials that would normally have been thrown away. Recycling limits the amount of waste and helps to extend the value and utility of an item. Proper recycling also reduces pollution risks by keeping materials out of disposal facilities.

- Sell your recyclable waste to the *kabadiwallas*.
- Give away clothes and other recyclable articles for charity.
- Join Freecycle movement to give away used articles.

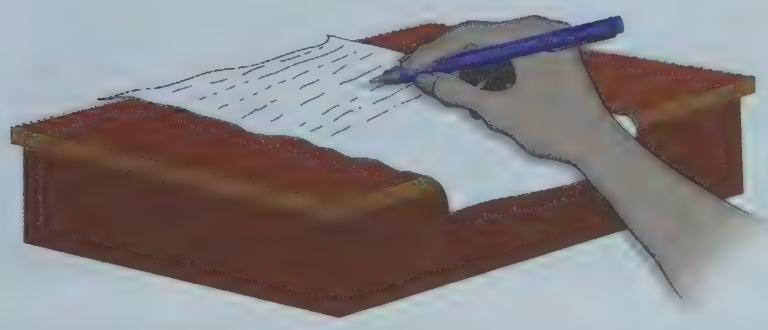
Use recycled goods

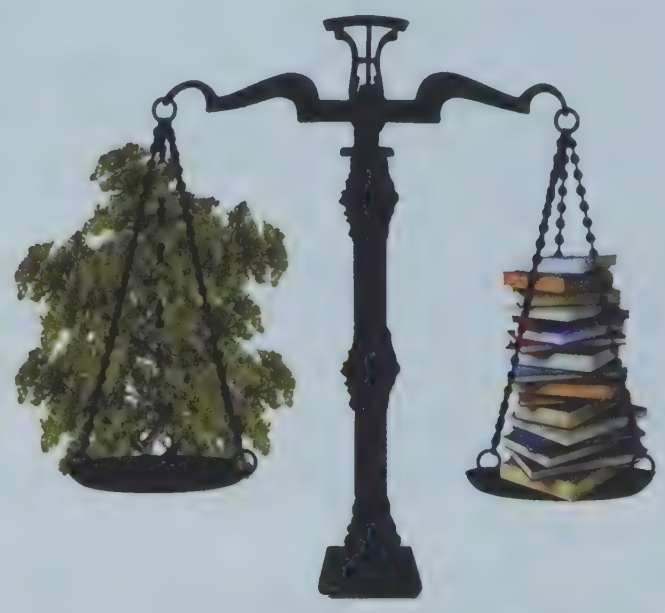
Whenever you can, buy things that are made from recycled materials. Here is a list of items you can buy: recycled paper notepads, writing paper and envelopes, tissue and toilet paper made from recycled paper and recycled copier paper. If people buy more recycled goods, firms will be more eager to make them. When you are using something that is recycled, encourage your friends to do the same.

Now learn more about recycling a variety of waste.

A. Recycling Paper

Paper is made from wood. Large plantations of trees are grown, and then cut down when they are fully-grown. The wood is turned into a pulp by mixing it with water. This pulp is gradually dried and rolled out to form large flat sheets of paper. It takes about 17 trees to make one tonne of paper. By recycling paper, we can ensure that fewer trees have to be cut down in the future. Trees are important because they absorb carbon dioxide and release oxygen, keeping our air breathable.





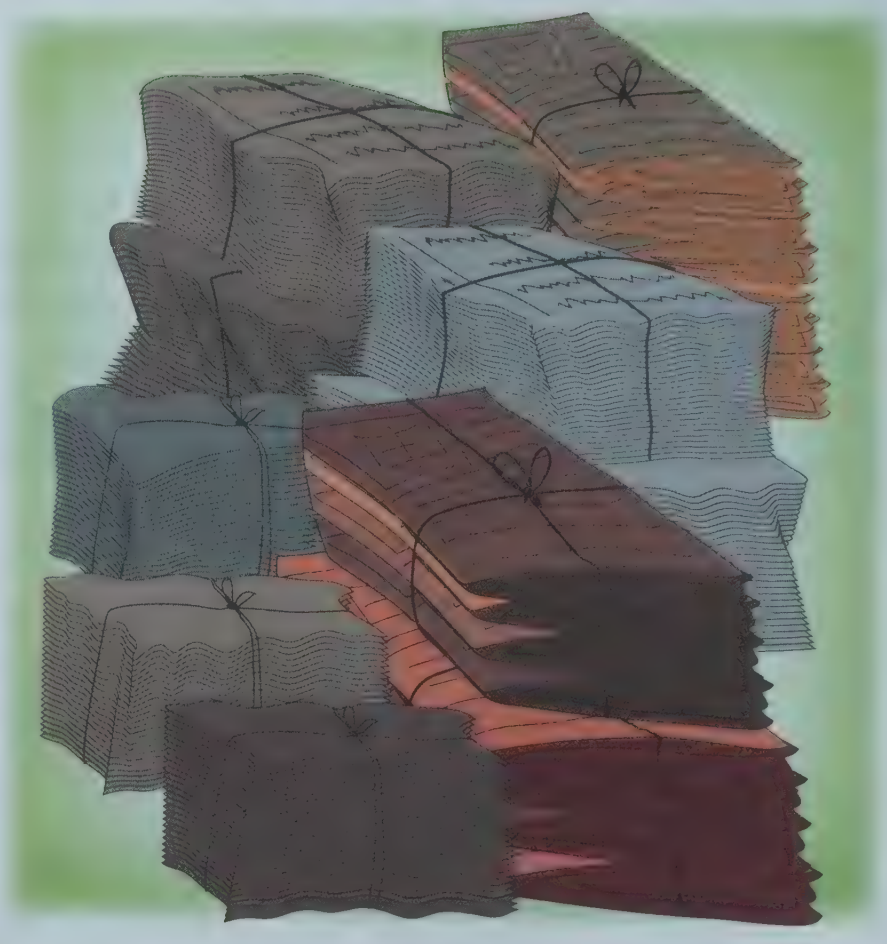
Most types of paper can be recycled. Virgin paper pulp prices have soared in recent years prompting construction of more plants capable of using waste paper. The key to recycling is collecting large quantities of clean, well-sorted, uncontaminated and dry paper.

Nearly all paper and cardboard can be recycled. Writing paper, newspapers, magazines and cardboard packaging (such as cereal boxes) can be recycled. Old phone books can also be recycled, along with envelopes and unwanted junk mail. Some household paper and card packaging cannot be recycled. Items such as juice cartons have a laminated layer of plastic inside. This layer of plastic keeps the carton leak-proof, but prevents it from being recycled. Be thoughtful about paper. Be conscious of how much you throw away that could be put to other uses

Here is what you can do to recycle paper

- Use paper carefully. If, in writing, you use both sides of the paper, you reduce waste by 50 %.
- Old envelopes, old bills and others, make good memo paper. Do not discard a memo sheet until it is full.
- Don't' burn discarded paper. Better to have it converted to mulch by pulping and composting it with other organic materials.
- Do not line drawers or shelves with paper if they are clean. Use leftover wallpaper, wrapping paper, or newspapers for the same.
- Young children like to draw, but clean wrapping paper or cardboard stiffeners from laundered shirts will do as well as new paper.
- Flatten corrugated cardboard and save it for return.
- Large grocery bags make good "containers" for an easy-to-handle bundle.

- Stack newspapers in bundles and save them for return to the *raddiwala*.
- Use the wax paper from inside empty cereal boxes or the ends of bread wrappers to wrap sandwiches for school and work lunches.
- Wrap gifts so that the gift-wraps, string, and ribbon can be used again. Avoid adhesive tapes.
- Before throwing away a piece of used sticky notepad, use it to clean the computer keyboard - just slide the sticky side between the rows of keys and see particles within get stuck instantly!
- Retain brochures and mailers that are printed on a single side since the other blank side can be used to scribble messages, shopping lists and etc.



- While carrying books or magazines in a bag, keep them crease-free by putting them inside a used envelope.
- For used envelopes that are much bigger in size, pack your slippers/shoes in them the next time you're traveling.
- Almost all paper contains some recycled paper. Look for those products, which contain the most reused paper. Some products feature completely recycled paper. Encourage recycling by buying such products.

B. Recycling Plastic

Plastic is a versatile product. Plastic can be flexible or rigid, transparent or opaque. It can look like leather, wood, or silk. It can be made into toys or heart valves. Altogether, there are more than 10,000 different kinds of plastics. The basic raw materials for plastic are petroleum and natural gas. These fossil fuels are sometimes combined with other elements, such as oxygen or chlorine, to make different types of plastic.

We seem to have a love-hate affair with plastic. We look down on plastic imitations of natural products and fibres. They are cheap, we say. We all want real leather, for example, rather than plastic imitations. Yet we are using plastic products more than ever before. We cover our food in plastic wrap, drink coffee from Styrofoam cups, wear clothes made from man-made fibres like nylon, polyester, rayon and even buy our plastic things with plastic credit cards! We use plastic extensively on a daily basis.

DID YOU KNOW?

In 1909, Leo Baekeland invented phenolics or Bakelite – a plastic material. Little would he have realized then what a profound effect this and other plastics would have upon our Earth and us?

Plastics are not the waste and energy culprits that some people think they are. Plastics are really very energy efficient. It takes less energy to manufacture a plastic shampoo bottle than a glass ketchup bottle. Moreover, plastics are lightweight; it takes less energy to transport a truckload of plastic shampoo bottles than a truckload of glass shampoo bottles.

Recycling plastic is easy. First, you should learn what types of plastic could be recycled and only give your scrap dealer those types of plastics. Plastics have different formulations and should be sorted before they are recycled to make new products. Mixed plastics can be recycled, but they are not as valuable as sorted plastics because the recycled plastic's physical properties, such as strength, may vary with each batch.

Recycle Plastic Waste

Once you know what kinds of plastics your recycler wants, you should follow the wash and squash rule - rinse the container and squash it. You may leave the paper labels on the container, but throw away the plastic caps. Plastic caps are usually made from a different type of plastic than the container and cannot be easily recycled.

Your toys, plastic hangers, trash cans, shelves, baskets, rain ponchos, and many other products can be recycled but products such as compact discs, video tapes and computer discs are made from mixed materials and can be only recycled after being disassembled. Plastic bags are nearly useless as a recycled material. They are collected only to make consumers feel good. We recommend that people don't bother to collect them and just don't use them.

Here are a few handy tips to recycle plastic

- Refuse plastic bags in supermarkets. Take your own 'environment friendly' shopping bag or ask your supermarket manager to provide paper bags.
- Avoid disposable plastic at home.

- Reuse polythene and polystyrene bags instead of throwing them after one-time use.
- Choose unwrapped fresh foods, rather than the same food wrapped in lots of plastic.
- Use ceramics for tableware rather than plastic varieties.
- Collect your waste plastic containers and sell them off to a scrap dealer either for a value or in exchange of useful articles.
- Use your water bottles for storage as well as gardening purpose; as a watering can or planter.
- Make useful decorative artifacts from plastic bottles and containers.

C. Recycling Glass

Glass is one of the easiest materials to recycle. It is 100% recyclable, it can be recycled indefinitely as its structure does not deteriorate when reprocessed, and recycling glass uses less energy, less raw materials and causes less pollution. Glass is made from the simplest of ingredients - silica, sand, soda ash and limestone. It contains no chemicals or substances that can harm the environment.

We already recycle a large amount of the glass packaging we bring home from the supermarket (wine bottles, jam jars, for instance). These are melted down and made into new bottles and jars. If we did not recycle glass, our bottles and jars would be made from fresh resources each time, and our landfill sites would be filled up even more by unwanted glass.

DID YOU KNOW?

Recycling glass saves 25% of the energy needed to make new glass. It cuts the amount of waste sent to landfills and reduces waste disposal costs. It also reduces the need for quarrying of raw materials thereby conserving the environment. Besides this, it creates employment from the processing centres and collection schemes. Thus, it helps in raising public awareness on waste management issues.

Bottles and jars can be recycled easily. Wine bottles, jam-jars and sauce jars are all recyclable; in fact, virtually all glass containers in which we buy our food and drink are recyclable. However, not all glass can be recycled. It is important not to mix the different types of glass when recycling at your waste bottle dealer. This check list will give you a good idea of what household items cannot be made into glass containers and should never be mixed with used glass bottles or jars put out for recycling. These are heat-resistant bowls, oven and microwavable cookware, drinking glasses, crystal glassware, chinaware such as plates, bowls, cups, saucers, figurines, vases, ceramic wine, liquor bottles, porcelain, like household insulators, sinks, toilets, ceramic tiles, clay flower pots, crystal glass, mirrors, window glass, plate glass, glass from television tubes, fluorescent tubes and light bulbs and lab glass.

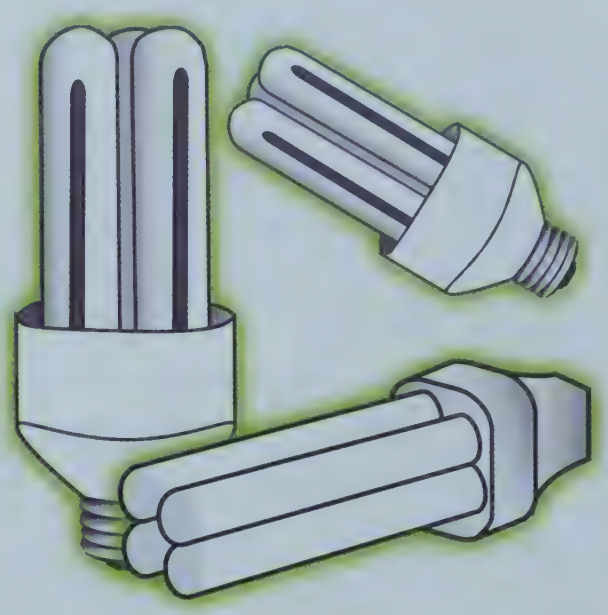
With your help, more and more glass can be recycled - saving valuable landfill space, natural resources and energy for a better environment for today and tomorrow.

Ways to recycle glass

- Don't choose a bottle if you can't re-use it! Whenever possible, buy drinks in returnable bottles, and take back empty ones to the shop they came from.
- Save bottles and jars for use at home. Use them to store food in the cupboard, and for homemade jam.
- Before you send glass jars to the recycling centre you might try to use them for other things, such as

storage of some foods. Other uses would include candle holders, flower vases, pencil holders, nail and screw holders and others.

- If you have large quantities of uniform size bottles, check with schools, nature centres, and museums. They use jars for collections and storage of certain material.
- Keep your empty jars and bottles in a box and take them to your waste bottle dealer on a regular basis. Make sure you rinse the bottle or jar out first (to get rid of any liquid or food that is still in there). Take the lid off the jars - these cannot be recycled with the glass.
- You can also buy special light bulbs, which are designed to last far longer than normal light bulbs. This means less light bulbs being thrown into your rubbish bins.



D. Recycling Metal

Metal is mined from the ground and comes in many different types. The most common types of metal we use in day life include iron, steel and aluminium. Metal is used in our home in a variety of ways, from window frames to bottle tops, from the wires in our plugs to paperclips. Metal is used extensively in our everyday products. Some of these products can be recycled or reused. Unwanted scrap metal can be melted down and turned into something useful. In addition, metal objects that you might consider useless could be extremely useful for someone else (an old bicycle, for instance). Some metal products can also be dangerous if left in rubbish bins. It can degrade and release substances harmful to the environment.

DID YOU KNOW?

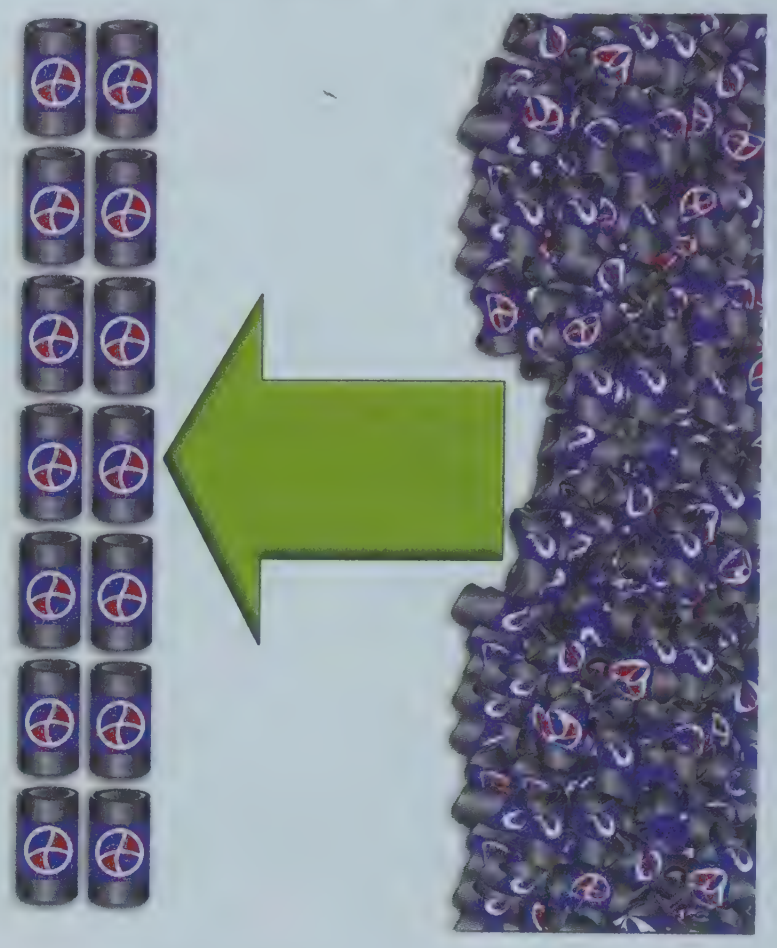
Metal recycling saves energy as making steel from scrap uses approximately one quarter of the energy needed to convert raw iron ore into steel; recycling aluminium uses only 5% of the energy required to make aluminium from bauxite. Recycling causes far less pollution of the air, water and soil, and it does not use large amounts of water, which are required when steel is produced from raw materials.

Used Batteries

Drinks' cans and tin cans are made from either aluminium or steel. Telling the difference between steel and aluminium cans is easy - any can should have a symbol on it telling you what it is made of. If in doubt, you will find that steel cans will stick to magnets while aluminium cans will not. Both steel and aluminium cans be recycled easily. Batteries come in different shapes and sizes and contain different metals and acids, some of which can be harmful if disposed of in landfill sites. Most batteries we use do not contain toxic chemicals, but some rechargeable batteries (made of nickel-cadmium) are toxic and should be sent back to the manufacturer. The small button shaped batteries found in watches and cameras can be recycled.

You can recycle metal and this is how you can do it

- Recycle food cans, pet food cans, aerosol cans, drinks' cans by selling it off to the scrap dealer or *kabadiwalla*.
- Check with the supermarkets whether they can start "Can Collection Centre".
- Keep aluminium can separate from steel ones, as aluminium scrap fetches a higher price than steel.
- Look for opportunities to recycle other aluminium goods (for instance foil, trays, food containers).
- Aluminium foil from packaged foods can be used as cookie sheets and brownie pans. However, when it reaches a point of no return, save it for collection.
- Indulge into indigenous practices of selling off your aluminium scrap to your scrap dealer in exchange for biscuits or garlic of same weight.
- Encourage schemes, which give you some discount in exchange for old pressure cookers, pressing irons and so on.



BE A FOREST AND ENVIRONMENT PROTECTOR

Forests stand as great storehouses of natural life. However, nearly two-thirds of the world's original forests are gone. Forests fall to the chainsaw at an accelerating pace, driven by an international timber trade that respects neither national boundaries nor ecological limits. Protecting forests requires governments to place some areas strictly off-limits to logging. Timber companies must adopt best-management practices that do not harm forest ecosystems. In addition, consumers must reduce, reuse and recycle wood and paper products.

Beside forests, we need to protect our immediate surroundings and deter from poisoning and polluting it by our anti-environment deeds.

DID YOU KNOW?

We cut forest right sitting in our homes and offices by using paper. We drive wild species to extinction by using wildlife products and create the hole in ozone layer by not using unleaded petrol.

Take these steps to protect and restore forests and your immediate surroundings

- Use electronic communications and non-paper learning resources.
- Organize local recycling projects.
- Use and promote convenient and practical paper recycling.
- Volunteer for tree-planting projects with your school or in your locality.
- Buy organically grown (pesticide free) fruits and vegetables, cotton clothing and other goods and jute-fibre products.
- Say no to one-time use disposable items such as plates, cups, spoons and others.
- Stop using pesticides. Green up your yard using natural products instead use traps, parasites and natural predators such as ladybird beetles. Use disease and pest-resistant plants.
- Use compost and mulch to improve soil health and reduce the need for pesticides and fertilizers.
- Include in your garden insect-repelling plants such as basil, mint, marigolds, and chrysanthemums.
- Buy household chemicals that are the least hazardous.
- While shopping for household items ensure least packing material.
- Always try to buy recycled products such as notepads, tissue paper, bags, boxes and so on.

- Look for the words “biodegradable” or “non-toxic” on the label.
- Look for “ozone friendly” labels on many products, which used to contain CFCs.
- Whenever possible, walk, bike, carpool or use public transport. (Reduces emissions by 20 pounds for every gallon of fuel used.)
- Say no to products made out of wildlife.
- Campaign about local environmental issues or enroll as BNHS or WWF member and volunteer in various campaigns and events organized by these organizations.

List of Resource Organizations

- AVEHI- Audio-Visual Resource Centre, Ravali Camp, Sion Koliwada, Mumbai- 400031.
- Bharati Vidyapeeth Environmental Education Research Institute (BVEERI) 4th Floor, College of Architecture Building, Bharati Vidyapeeth, Pune-Satara Road, Katraj, Pune-411043.
- Bombay Natural History Society, Conservation Education Centre, Near Film City, Goregaon (East), Mumbai - 400065.
- Center for Environment Education, Thaltej Tekra, Ahmedabad- 380054.
- Central for Cultural Resources and Training (CCRT), Bhawalpur Houses. Bhagwandas Road, New Delhi 110001.
- Centre for Science and Science and Environment (CSE), Audio- Visual Unit, F-6, Kailash Colony, New Delhi 110048.
- C.P.R Environmental Education Centre, 1, Eldams Road, Chennai- 600018.
- Maharashtra Nature Park, Opp. Dharavi Bus Depot, PMGP Colony, Dharavi, Mumbai 400017.
- National Council of Educational Research & Technology (NCERT), Sri Aurobindo Marg, New Delhi 110016.
- Tata Energy Research Institute (TERI), Darbari Seth Block Habitat Place, India Habitat Centre New Delhi- 110003.
- Uttarakhand Seva Nidhi, Champa Naula, Manorath Sadan, Almora, Uttar Pradesh 263601.
- World Wide Fund for Nature- India (WWF-|),171-8, Lodi Estate, New Delhi- 110003.

List of Internet Sites for Environmental Issues

1. www.5tigers.org
2. www.animal.discovery.com
3. www.bagheera.com
4. www.barkingbuddies.com
5. www.bbc.co.uk/reallywild
6. www.biodiversity.environment.gov.au
7. www.birdlife.org
8. www.bnhs.org
9. www.britanica.com
10. www.bugbios.com
11. www.care2.com
12. www.ceeindia.org
13. www.conservation.org
14. www.corporatewatch.org
15. www.cozuca re.or9
16. www.defenders.com
17. www.earthlink.co.au
18. www.earthsystems.org
19. www.eco rcycle.vic.gov.au
20. www.enalure.com
21. www.endangered.fws.org
22. www.endangeredspecie.com
23. www.enn.com
24. www.envfor.nic.in
25. www.envirolink.org
26. www.environment.about.com
27. www.essential.org/mrc
28. www.geocities.com/rainforesV29S
29. www.greenindus.com
30. www.greenpeace.org
31. www.igc.apc.org/ran
32. www.irn.org
33. www.iucn.org
34. www.kidsplanet.org
35. www.moforestchief.com
36. www.nationalgeographic.co.in
37. www.navneet.com
38. www.nwf.orglkids
39. www.PETA India.com
40. www.sanctuaryasia.com
41. www.seaworld.com
42. www.stopextinction.org
43. www.theecologist.com
44. www.traffic.org
45. www.wcmc.org.uk
46. www.panda.org
47. www.uneo.ch
48. www.vic.waterwatch.org
49. www.wcmc.org.uk
50. www.wii.gov.inlenvhome/Eindex
51. www.wild.allindia.com
52. www.wildlife-vjdarbha.org
53. www.worldwatch.org
54. www.worldwildlife.org
55. www.wri.orgloceans/index.html

Notes

Notes

ECO-CALENDAR

DATES	EVENTS
14th - 30th January	Animal Welfare Fortnight.
2nd February	World Wetlands Day.
28th February	National Science Day.
21st March	World Forestry Day.
22nd March	World Day for Water.
23rd March	World Meteorological Day.
7th April	World Health Day.
22nd April	Earth Day, Water Resources Day.
28th April	World Heritage Day.
5th June.	World Environment Day.
17th June	World Day to combat desertification and drought.
1st July	Vanmahostav Day.
6th August	Hiroshima Day.
9th August	International Day of World's Indigenous people.
16th - 18th September	Clean up the World Campaign.
2nd - 8th October	Wildlife Week.
2nd October	International Natural Disaster Prevention Day.
4th October	World Habitat Day.
5th October	World Animal Welfare Day.
11th October	International Day for natural Disaster Reduction.
16th October	World Food Day.
24th October	World Development Information Day.
1st - 7th November	World Ecology Week.
19th Nov. - 18th Dec.	National Environment Month.
24th November	World Biodiversity Conservation Day.
2nd December	Bhopal Tragedy Day / Zoo Week.
3rd December	World Conservation Day.
29th December	International Day for Biological Diversity.

Green Guide For Teachers

The Green Guide has been designed as a resource manual for environmental educators from formal as well as non-formal sectors. The guide is an excellent compilation of interesting facts and concepts from the field of wildlife and environment. It aims to enhance the classroom experience wherein the educators could use the information from the guide as brain teasers and make their teaching more effective. It especially equips every educator with authentic and updated knowledge on natural history and environment, which is vital for environment education.

BNHS INDIA CONSERVING NATURE SINCE 1883

MMR ENVIRONMENT IMPROVEMENT SOCIETY